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SPONGES OF THE GULF OF CALIFORNIA

(PLATES 1-97)

MALCOLM GIBSON DICKINSON

INTRODUCTION

The Gulf of California is a geographical unit. Its boundaries are definitely established by land on three sides. It is also, in a sense, a time unit, since its beginnings in the Eocene, extension in the Miocene, and continued existence to the present give it a definite age.

These durational boundaries make the region unique among the marine areas of a like size. Most coastal regions of the present oceans, such, for example, as the coast of California or even the Gulf of Mexico, have existed throughout known time, undergoing many changes of shape and shore but still continuing to exist.

These unusual features give the fauna of the Gulf of California a peculiar interest. It came into being in the Eocene and Miocene periods when, for at least part of the time, a water connection existed between the Atlantic and Pacific Oceans across Mexico. No known earlier fauna existed in the region, and it is there that a migratory fauna might be expected to establish itself. For this reason a study of the fauna of the Gulf region should logically be expected to furnish evidence on the ancestry and relationships of many of the Pacific coast forms.

With the exception of the work done on the cruise of the *Albatross* in 1891, the sponges of the Gulf of California have not been collected for a detailed scientific study. The records indicate that on the *Albatross* cruise three species of sponges were collected from the Gulf of California. All of these were deep-water forms, since the *Albatross* collecting was done largely at considerable depth. Such sponges are not of great significance as representative forms of a region, since the deep-water sponges are almost invariably cosmopolitan.

This lack of data on the sponge fauna to the south of California, including the Gulf region, has made it difficult to properly relate the sponges of California to those of other geographic areas. The California sponges have long been considered to be an isolated group, their origin a puzzle, and their relatives unknown.

With this background, the author began in 1935 his study of the sponges of the Allan Hancock Foundation collections. The results of

those years of study are presented herein in the form of a detailed taxonomic report on the sponges of the Gulf of California, together with the comparison of this fauna with that of the West Indies and of the coast of California.

Acknowledgments

The writer wishes to express sincere thanks to Dr. M. W. de Laubenfels, whose advice at all stages has been invaluable and whose generosity with reprints, personal library, and other material has been most helpful.

Materials and Technique

The sponges herein described were collected by members of the Allan Hancock Pacific Expeditions in 1933, 1934, 1935, 1936, 1937, 1939, and 1940. All collecting was done in December, January, February, March, and April. Over six hundred specimens were collected on the cruises of the *Velero III* from the Gulf region, which represent all 3 classes of sponges, 10 orders, 30 families, 56 genera, and 67 species. Twenty- six new species and one new genus were found.

The technique used in preparing the sponges is as follows: The animals, on collection, were placed directly into 95 per cent alcohol. Sufficient alcohol was added from time to time to keep the concentration above 80 per cent. For making slides, a thin slice of the sponge was taken perpendicularly and tangentially to the surface. This was done with a razor blade, as considerable depth was needed on the slide for proper identification. Sections up to .5 mm were used with good results. The bits of sponge were placed directly on the slide and flooded with 95 per cent alcohol, to which a small amount of basic fuchsin had been added. This solution was then blotted off. Absorbent paper toweling was found to be excellent for this purpose. Then the specimen was washed with absolute alcohol, blotted, and cleared with a saturated solution of carbol-xylene. The carbol-xylene was then removed with clear xylene and again blotted. Balsam was placed on the specimen and the cover slip pressed into place. A heavy balsam, warmed to the proper fluidity, was used without injury to the specimen. This was an advantage because the sections were rather thick and light balsam tended to run from under the cover slip.

The system of identification used throughout this paper follows the revision made by M. W. de Laubenfels (1936). The only other modern system is that of Hentschel (1923). His classification was very incomplete in the class Demospongia. He dealt with only 340 genera of the 602 definitely established in his time.

Since 1923 more than one hundred genera have been published. As this paper deals largely with the Demospongia, Hentschel's system is not practical. Earlier systems such as those of Minchin (1900) and Vosmaer (1885) are not useful in present-day work, both because they are necessarily incomplete and because they are not based on modern methods of identification.

A TAXONOMIC ANALYSIS OF THE SPONGES OF THE GULF OF CALIFORNIA

The taxonomic analysis developed in the following pages presents first the order Keratosa, which is a complex and highly evolved group, and proceeds to the order Carnosa, which is primitive. Keratosa contains the type of the Phylum, as well as those sponges which are commercially valuable. For this reason the order is much studied. It is of historical interest because the keratose sponges are pictured on Grecian bas-reliefs, perhaps the oldest known recording of marine invertebrates. The Carnosa have evolved little beyond what is probably the most primitive Demospongia. The group of Carnosa is small; it contains no species of commercial value and is little studied. Because it is primitive, it is more closely related to the class Calcarea, which, since it is represented by few specimens in the Hancock collection, is discussed last.

Since many of the original descriptions of sponges need clarifying and interpreting in terms of modern, uniform taxonomical usage, all species studied, whether new or old, are described herein.

Order **KERATOSA** Bowerbank
Family **Spongiidae** Gray
Genus **HALME** Lendenfeld
Halme hancocki, new species

Plates 1, 2, Figs. 1-4

Diagnosis.—The specimen is a thin incrustation 8 by 5 by .5 cm and is apparently a fragment of a much larger mass. In alcohol the color is drab, both internally and externally. The color in life is not recorded. The consistency is distinctly fleshy and very firm to the touch. Conules are present on the surface, which is deeply pitted. Each depression is 2 to 3 mm in diameter and separated from the next only by a very thin wall. The whole appearance is that of an empty honeycomb. The entire specimen is exceptionally free of foreign material on the surface. The underside is quite smooth, except for occasional depressions probably due to irregularities in the surface of the coral on which the sponge grew.

Oscules, which vary in size from about 1,500 to 2,500 μ in diameter, are irregularly scattered over the surface. The pores are not visible to the naked eye.

Flagellate chambers are usually about 25 by 35 μ, but occasional smaller ones are observed. They are diploidal, as is characteristic of the family.

Ascending fibers average 150 μ in width, but vary between 120 μ and 165 μ. The tangential fibers very between 70 and 125 μ with an average near 100.

Holotype.—AHF no. 1.

Type locality.—Isabel Island, Sinaloa, Mexico; porites coral; 4 m.

Distribution.—Gulf of California.

Material examined.—

Sta. 125-33 Isabel Island 3-19-33 4 m

Remarks.—The specimen differs from most of the genus in that it does not have sand particles at the nodes and also in that it has both relatively very large secondary fibers and very large amounts of detritus in the primary fibers.

It is most like the sponge first described as *Holopsamma laminae-favorsa,* Carter 1885, from Australia, but that sponge had a smooth ectosome, whereas the Hancock specimen possesses conspicuous cornules. Furthermore, *H. laminae-favorsa* had main fibers made up of sand grains with little spongin and tangential fibers only 16 μ wide. *H. hancocki* has a large amount of detritus irregularly placed in the primary fibers but no sand grains at the nodes, much spongin, and exceptionally wide tangential fibers (100 μ as compared to 16 μ average).

Genus **HIRCINIA** Nardo

Hircinia fusca Carter

Plate 3, Fig. 5

Hircinia fusca Carter, 1880, p. 36.

Diagnosis.—This sponge has a ramose to digitate shape, is brown in life, and is rather firm in consistency.

The principal tracts have a diameter of 100 to 180 μ and have much detritus. The mesh of the fibers is about 1,000 μ in diameter. Filaments are abundant and average about 3 μ in thickness.

Holotype.—Liverpool Free Museum.

Type locality.—European waters.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 650-37 San Fransisco Island 3- 9-37 92 m

Remarks.—This sponge does not differ materially from published descriptions of the holotype.

Genus VERONGIA Bowerbank
Verongia thiona de Laubenfels
Plate 3, Fig. 6

Verongia thiona de Laubenfels, 1930, p. 28.

Diagnosis.—*Verongia* is an incrustation, spongy and yellow in life, turning blue or purple on drying. The fibers, which are laminate, are clear yellow. "Histological details: The flagellate chambers are spheroidal, 25 μ in diameter. Principal fibers 80 to 150 μ in diameter, cored by the usual pith as found in this genus. Pith of the fibers, 50 μ to 100 μ in diameter." (de Laubenfels 1932, p. 124.)

Holotype.—U.S.N.M.

Type locality.—Laguna Beach, California.

Distribution.—Southern California to the Gulf of California.

Material examined.—

Sta.	554-36	Angel de la Guardia Island	3- 8-36	20 m
Sta.	633-37	Espiritu Santo Island	3- 6-37	36 m
Sta.	1040-40	Guaymas Bay	1-23-40	Shore
Sta.	1073-40	Rocky Point, Sonora	2- 3-40	20 m

Remarks.—The specimens agree closely with the type specimen described from Laguna, although in the Gulf specimen the principal fibers are somewhat smaller (100 μ maximum, and the pith only 30 to 60 μ).

Family Dysideidae Gray
Genus DYSIDEA Johnston
Dysidea amblia de Laubenfels
Plate 4, Figs. 7, 8

Duseideia amblia de Laubenfels, 1930, p. 28.

Dysidea amblia de Laubenfels, 1932, p. 123.

Diagnosis.—"Shape, digitate somewhat ramose. Size, up to 20 or 30 cm in height, about 1 cm in diameter. Consistency spongy. Color, in alcohol, drab. Oscules, inconspicuous, barely 100 μ in diameter. Pores, not evident. Surface, superficially conulose with conules usually less than 1mm high and less than 1 mm apart.

"Ectosomal specialization, a very thin dermis, not detachable. Endosomal structure, a fibrous reticulation with meshes about 250 μ in diameter. Principal or ascending fibers, 100 μ to 200 μ in diameter. Cored, sometimes superabundantly, by scattered sand grains often more than

100 μ in diameter. Accessory or transverse fibers 10 μ to 25 μ in diameter, often uncommon, usually free from inclusions. The flagellate chambers are conspicuous, crowded together, and about 45 μ to 55 μ in diameter." (de Laubenfels, 1932, p. 123.)

Holotype.—U.S.N.M.

Type locality.—"Long Wharf," Santa Monica, California.

Distribution.—Reported from Carmel, California, to the Gulf of California.

Material examined.—

Sta. 720-37 Rocky Point, Sonora, Mexico 3-24-37 12 m

Remarks.—The material examined agrees very closely with the southern California material, although the flagellate chambers are, on the average, somewhat larger and the mesh somewhat smaller in the Gulf specimens than is typical of specimens from southern California. In the latter respect the Gulf specimens are even closer to *Dysidea fragilis* of the West Indies than are the California specimens, indicating, perhaps, that the West Coast sponge may have evolved from the West Indies and that the differences became more marked as it spread north.

Order **HAPLOSCLERINA** Topsent
Family **Haliclonidae** de Laubenfels
Genus **HALICLONA** Grant
Haliclona cinerea (Grant)

Plate 5, Figs. 9, 10

Spongia cinerea Grant, 1827, p. 204.
Halichondria cinerea Fleming, 1828, p. 521.
Isodictya cinerea Bowerbank, 1866, p. 274.
Reniera cinerea Schmidt, 1870, p. 77.
Haliclona cinerea de Laubenfels, 1932, p. 120.

Diagnosis.—This is an encrusting form, drab in alcohol, and about 6 x 2 x 4 cm thick. Oscules are conspicuous over the surface and average 4 mm in diameter. The surface is very irregular with many porelike depressions. The endosome has vague tracts of spicules forming an irregular reticulation. The sole type of spicule is an oxea. Typical specimens from the Gulf of California show the following spicule measurements:

Specimen 1—5 x 115 μ
Specimen 2—6 x 140 μ
Specimen 3—4 x 190 μ

Holotype.—Probably in the British Museum of Natural History.

Type locality.—Europe.

Distribution.—This species is cosmopolitan, having been reported from all parts of the world, notably from southern California.

Material examined.—

Sta.	515-36	San Francisco Island	2-24-36	Shore
Sta.	584-36	Concepción Bay	3-14-36	16 m

Remarks.—There is a considerable variation within the specimens examined, and it is possible to match the variations in spicule size with published variations in species. However, it appears preferable to identify all these specimens with the older cosmopolitan species, which should probably receive many of the *Haliclona* in synonymy.

Haliclona palmata (Ellis and Solander)

Plate 6, Figs. 11, 12; Plate 7, Fig. 13

Spongia palmata Ellis and Solander, 1786, p. 189.
Haliclona palmata Burton, 1930, p. 511.

Diagnosis.—Specimens of this sponge are semiglobular, resilient, and drab in alcohol. Gemmules are present in some specimens. Their most characteristic size is 160 by 200 μ. The internal structure is typical Haliclonid architecture with the suggestion of reticulation and the lack of dermal specialization. The oxeas are 4 by 45 μ with very little variation and no differences in arrangement or size for the various sections of the sponge.

Holotype.—British Museum.

Type locality.—European waters.

Distribution.—Cosmopolitan.

Material examined.—

Sta.	515-36	San Francisco Island	2-24-36	Shore

Remarks.—The Hancock specimens of *Haliclona palmata* look, superficially, somewhat like *H. lunisimilis* de Laubenfels from Pacific Grove, California; but the oxeas are, as noted above, only 4 by 45 μ as compared with 8 to 10 by 110 to 125 μ in *H. lunisimilis*. It is possible that the specimens should be classified with those mentioned above as *H. cinerea* or with *H. lunisimilis;* but *H. palmata* is also well established and cosmopolitan, and the spiculation of our specimens is much closer to it than to that of either of the others.

Haliclona permolis (Bowerbank)

Plate 7, Fig. 14; Plate 8, Fig. 15

Isodictya permolis Bowerbank, 1866, p. 278.
Isodictya ramuscula Bowerbank, 1866, p. 314.
Haliclona permolis de Laubenfels, 1936, p. 38.

Diagnosis.—This is the cosmopolitan, lavender sponge, which is softly spongy and rather slimy to the touch. The Gulf specimens have oscular chimneys shaped like volcanic cones sometimes 1 cm high over the surface. Oscules are about 2 mm in diameter. Pores 200 μ in diameter are abundant. There are no spicules in the dermis and no subdermal cavities. Specimens are 1 cm thick and cover an area averaging 25 cms square. The internal structure is an isodictyal reticulation of oxeas averaging 5 by 130 μ.

Holotype.—British Museum.

Type locality.—British waters.

Distribution.—World wide.

Material examined.—

Sta. 515-36	San Francisco Island	2-24-36	Shore
Sta. 586-36	Concepción Bay	3-14-36	8 m

Remarks.—This specimen has been previously reported from Albemarle Island, Galapagos, by earlier Hancock Pacific Expeditions and again from Albemarle Island by members of the Presidential Cruise to those waters in 1938, as well as near Panama City by de Laubenfels in 1933. It has also been reported from nearly all oceans of the world. It is easily identifiable by its unvarying lavender color. This is one of the few instances where color seems important in sponge identification.

Family **Callyspongiidae** de Laubenfels

Genus **CALLYSPONGIA** Duchassaing and Michelotti

Callyspongia californica, new species

Plate 8, Fig. 16; Plate 9, Figs. 17, 18

Diagnosis.—The specimen of this sponge is a fragment 5 cm long, 4 cm wide, and slightly more than 1 cm high. The general form tends to be somewhat ramose. The consistency is from mediocre to fragile, and the entire specimen is translucent but brownish in color, both internally and externally.

The surface is superficially smooth. There appears to be a surface membrane about 100 μ thick, which is very tightly held. Uniformly scattered over the specimen are openings 200 μ in diameter. There are in addition larger openings 2 mm in diameter. These tend to occur at the end of the branches, but this is not always the case.

The spiculation, as is typical in *Callyspongia,* consists exclusively of small oxeas and is tangential. The oxeas are rather larger than is usual for this genus. Many were found which measured 5 by 150 μ, but the average size is more nearly 3 by 80 μ. The ascending fibers are 25 μ wide

and contain about 20 rows of spicules. The fibers are largely spongin, containing but very little detritus. The primary dermal mesh measures 130 by 220 μ as an average. The second mesh is about 100 μ square.

Holotype.—AHF no. 2.

Type locality.—Tangola Tangola Bay, Mexico; Lat. 15° 45′ 37″ N, Long. 96° 05′ 24″ W, Tangola Tangola Island.

Distribution.—Same.

Material examined.—

Sta. 261-34	Tangola Tangola	3- 1-34	Shore

Remarks.—This specimen differs from *Callyspongia vaginalis* Lamarck in the size of the oxeas, which frequently measure 5 by 150 μ with an average of 3 by 80 μ as compared with an average of 3 by 50 μ for *C. vaginalis,* which has an upper limit of 4 by 70 μ. *C. ridley* Burton is the only species that has such large spicules. This specimen, which was collected in Australia, has oxeas that measure 8 by 200 μ.

The coarser dermal fibers of *C. vaginalis* vary from 30 to 70 μ and form a mesh 130 to 400 μ in diameter. The specimen under discussion shows main fibers which vary little from 25 μ and a primary mesh which rarely exceeds 220 μ. The finer dermal strands of the Hancock specimen measure 8 μ wide as compared with an average of 15 μ for *C. vaginalis* and form a mesh about 100 μ square as against 80 μ.

This specimen is also very much smaller with tubes much shorter than *C. vaginalis,* which has a typical tube length of 20 cm as compared with 1 cm. The texture is more delicate and does not exhibit the characteristic conules.

In reviewing the species of *Callyspongia* for purposes of comparison, it was noted that the species described by Lendenfeld, 1912, p. 2, as *Spinosella infundibulum* should not be left in *Callyspongia.* In general, of course, *Spinosella* falls in synonymy to *Callyspongia,* but on the basis of Lendenfeld's description his *infundibulum* belongs in the Haliclonidae, the genus *Cribrochalina.*

Although this specimen is not properly from the Gulf of California region, it seems expedient to include it in the present paper, since its location to the south places it directly in the path which was probably followed by the present sponge fauna of the Gulf of California as it migrated from the West Indies. A water passage across Mexico connecting the Atlantic and the Pacific existed in the late Miocene period.

Order POECILOSCLERINA Topsent

Family Adociidae de Laubenfels

Genus ADOCIA Gray

Adocia gellindra de Laubenfels

Plate 10, Figs. 19, 20

Halichoclona gellindra de Laubenfels, 1932, p. 114.
Adocia gellindra de Laubenfels, 1936, p. 71.

Diagnosis.—"Shape encrusting, size 2 to 4 mm thick, somewhat more than 4 square cm in area. Consistency, fragile. Color in life, pale lavender. Oscules, few and irregular in shape, about 1 mm in diameter, often with raised collars nearly 1 mm high. Pores, abundant, 30 μ to 50 μ in diameter. Surface, superficially smooth.

"Ectosomal specialization, a crust of tangentially placed oxeas, its thickness only about 20 μ. Endosomal structure, oxeas in very regular isodictyal reticulation, united at their apices only.

"Principal spicules, oxeas size 3 μ by 110 μ to 4 μ by 120 μ. The specimen from Laguna Beach, California, had spicules 8 μ by 150 μ to 10 μ by 170 μ." (de Laubenfels, 1932, p. 114.)

Holotype.—U.S.N.M.

Type locality.—Carmel, California.

Distribution.—Reported from Carmel, California, to the Gulf of California.

Material examined.—

Sta.	728-37	San Esteban Island	3-27-37	Shore

Remarks.—The oxea size (5 by 145 μ to 8 by 180 μ) of the Gulf specimens is rather larger than the typical size found in the holotype but corresponds very closely with the sizes reported from the specimens found at Laguna Beach, California.

Adocia ambrosia, new species

Plate 11, Figs. 21, 22; Plate 12, Figs. 23, 24

Diagnosis.—The specimen of this sponge is 14 cm long, 4 cm wide, and 3 cm thick. It is rather ramose in general form. In texture it is woody, and in color a light drab when preserved. The surface is superficially smooth, and there is a definite tangential dermal skeleton, nondetachable, averaging 600 μ in thickness. The specimen appears to be a fragment of a larger mass.

Pores are abundantly scattered all over the surface, although they are too small to be seen with the naked eye. The average diameter of these openings is 30 μ.

Oscules are also found. They vary in size up to 4,000 μ with an average of 3,500 μ. The spiculation is, in general, tangent and reticulate. The principal megascleres are exclusively diacts with an average size of 14 by 240 μ, and there is little variation from the average. A second category of oxeas, averaging 3 by 130 μ, with very little size variation is also present.

Holotype.—AHF no. 3.

Type locality.—East of San Marcos Island, Mexico; 12 fms; sand bottom.

Distribution.—Same.

Material examined.—

Sta. 581-36 San Marcos Island 3-14-36 24 m

Remarks.—This *Adocia* differs from *A. gellindra,* also found in the Gulf, chiefly in the size of the principal oxeas, which are almost twice as large, and in the possession of a second class of megascleres. In the latter respect it is like *A. neens,* a West Indian sponge, but *A. neens* has much smaller spicules and has a protoplasmic mesh at the surface resembling that found in *Callyspongia.* It might be added that the ramose shape and drab color of the new species contrast with the lavender color and encrusting form of *A. gellindra.*

Genus **PELLINA** Schmidt

Pellina semitubulose (Lieberkühn)

Plate 13, Figs. 25, 26

Halichondria semitubulose Lieberkühn, 1859, p. 363.

Diagnosis.—The specimen is a paper-thin tube 3 or 4 mm in diameter and 25 mm long. It is broken at one end.

The ectosome is raised and easily detachable, since it covers subdermal spaces. It contains tangentially placed spicules. The endosome has a well-defined isodictyal reticulation.

The sole kind of spicule is the smooth oxea. These are most frequently 5 by 130 μ, but there is considerable range from 10 by 125 μ to 2 by 50 μ.

Holotype.—Unknown.

Type locality.—Mediterranean.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 640-37 San Lorenzo Channel 3- 7-37 60 m

Remarks.—The tube described above is beyond doubt an oscular chimney broken from the basal mass, of which only fragments are left along with the tube.

Genus SIGMADOCIA de Laubenfels

Sigmadocia edaphus de Laubenfels

Plate 14, Figs. 27, 28; Plate 15, Fig. 29

Gellius edaphus de Laubenfels, 1930, p. 28.
Sigmadocia edaphus de Laubenfels, 1936, p. 69.

Diagnosis.—This is a rather massive sponge, almost stony hard, and, when preserved, white in color. Oscules 1 to 2 mm in diameter are often present. The surface appears to be smooth. There is a well-developed dermal layer, although it is only 10 to 20 μ thick and not easily detachable. Tangentially placed spicules are present in this special layer.

The spiculation is typical of the family and genus, consisting of oxeas as large as 18 by 400 μ with considerable variation down to 10 by 225 μ. The microscleres are sigmas only and these average 40 μ in length.

Holotype.—U.S.N.M.

Type locality.—Pescadero Point, California.

Distribution.—Pescadero Point south to the Gulf of California.

Material examined.—

Sta. 667-37	Carmen Island	3-12-37	120 m

Remarks.—The oxeas in these specimens average somewhat larger than the specimens from central and southern California (15 by 270 μ as against 18 by 400 μ); but there is considerable variation within all specimens, so that overlapping occurs at least to some extent. The microscleres are of about the same length in specimens from all locations.

Family Coelosphaeridae Hentschel

Genus RHIZOCHALINA Schmidt

Rhizochalina pacifica, new species

Plate 15, Fig. 30; Plate 16, Figs. 31, 32

Diagnosis.—The Hancock specimens of this sponge appear to be oscular chimneys or lipostomous fistules torn from a basal plate or mass, only fragments of which are present.

The specimens are white, averaging about 3 cm long and from .5 cm to 1 cm in diameter. The surface, which is tough and leathery, is white in alcohol and pierced by abundant pores about .5 mm in diameter. There are oscules at the ends of most of the chimneys. These are 2 or 3 mm in diameter. The surface is slightly hispid.

The endosome is not dense and is held together between the tough ectosome and the fleshy cloacal dermis.

The only spicules are oxeas, which are about 30 μ by 1,300 μ. There is little size variation, although rare thinner and longer oxeas are found.

The principal fibers are 50 μ in diameter and contain 4 spicule rows. The secondary fibers are difficult to make out and contain only occasional spicules. Spicules are also scattered in confusion outside the fibers.

Holotype.—AHF no. 4.

Type locality.—San Jaime Banks, off Cape San Lucas, Mexico; Lat. 22° 50′ 30″ N, Long. 110° 15′ W; old coralline algae, granite rocks.

Distribution.—Gulf of California.

Material examined.—

Sta. 618-37 San Jaime Bank 3- 3-37 150 m

Remarks.—The San Jaime Banks are not in the Gulf of California; but their location near the mouth, plus the fact that the sponge fauna from there is, in most cases, also found in the Gulf proper, makes the location an integral part of the region as far as this study is concerned.

There is no other *Rhizochalina* reported from the west coast of the Americas. In fact, none has been reported from the American zone of the Pacific Basin. The nearest relative appears to be *R. sessilis* Kirkpatrick, 1900, from the East Indies. This had a pyramid to fingerlike shape, but its oxeas are only 14 by 372 μ. This is a large difference. The principal tracts are much larger and contain 10 rows of spicules, while the secondary tracts are about the size of the principal tract in the Gulf species and contain 3 rows of spicules. *R.oleracea* Schmidt, 1870, which is the genotype, is somewhat similar, but has even smaller spicules than *R. sessilis.* It is West Indian.

Family **Plocamiidae** Topsent

Genus **PLOCAMIA** Schmidt

Plocamia karyoka, new species

Plate 17, Figs. 33, 34; Plate 18, Fig. 35

Diagnosis.—This is an encrusting sponge, rather firm in consistency, with branching protrusions often several mm in diameter, making up the bulk of the specimen. The preserved material from the Gulf is, of course, drab.

The endodermal structure is interesting in that its ascending columns with connecting spicules give it a ladderlike appearance under the low power of a microscope.

The principal spicules are subtylostyles with microspined heads; size 18 μ by 340 μ. Secondary spicules, strongyles with microspined heads; size 16 μ by 200 μ to 22 μ by 175 μ. Interstitial spicules, tylostyles; size 12 μ by 200 μ to 3 μ by 160 μ. First microsclere, palmate isochelas of a peculiar twisted form; length 10 μ to 17 μ. Second microsclere, toxas; length 18 μ to 80 μ.

Holotype.—AHF no. 5.

Type locality.—Isabel Island, Mexico; 40 m; dead shells and sand.

Distribution.—Same.

Material examined.—

Sta. 974-39 Isabel Island 5- 9-39 Shore

Remarks.—This sponge is close to *Plocamia karykina* of California, but the tylostyles are much longer (18 μ by 340 μ) and there are strongyles instead of tylotes. The most interesting feature of this specimen is the peculiar contortion of the palmate isochelas. One palm on nearly all of them is turned at right angles to the other, making them difficult to identify as to type. This type of contortion is common with sigmas but relatively rare with chelas. Such contortion never occurs in *P. karykina* from California.

Genus **PLOCAMIONIDA** Topsent

Plocamionida igzo de Laubenfels

Plate 18, Fig. 36

Plocamia igzo de Laubenfels, 1932, p. 102.

Plocamionida igzo de Laubenfels, 1936, p. 78.

Diagnosis.—This is an encrusting sponge, stiff to woody in consistency, and drab in alcohol. California specimens are red in life. Oscules are rarely present, and the surface specialization is not evident to the naked eye.

The endosome is of the plumose type of architecture but not closely organized.

The spiculation is rather typical of the genus with smooth to microspined tylostyles 11 μ by 190 μ to 35 μ by 340 μ as dermal spicules, spined tylotes 13 μ by 130μ as principal spicules, and arcuate chelas 14 μ long.

Holotype.—U.S.N.M.

Type locality.—Point Piños, California.

Distribution.—Central California to the Gulf of California.

Material examined.—

Sta. 277-34 Isabel Island 3- 5-34 30 m

Remarks.—Perhaps it is worthy of note that both *Plocamionida* and *Plocamia* are found at Isabel Island and are common in the same locality in central California. In view of this fact we might well be justified in considering them as variations of the same genus. However, the chelas are very different, and this has been frequently used as a basis for separation. The peculiar contorted chelas of the Isabel Island *Plocamia* make them resemble, if somewhat superficially, the more primitive types. Dropping the two into synonymy will, probably, be justified but at present awaits further material for study.

Family **Cyamonidae** de Laubenfels

Genus **CYAMON** Gray

Cyamon argon, new species

Plate 19, Figs. 37, 38

Diagnosis.—This sponge is bushlike in appearance. It covers an area of 4 by 2 by 3 cm. The preserved specimen is dark brown in color. The consistency is firm and corklike, and the surface is extremely uneven and covered with branchlike projections 1 cm long by 1 mm in diameter. The entire surface is hispid to 500 μ. Neither pores nor oscules can be found.

The main mass of this sponge consists of closely packed triacts covered with low, blunt spines especially at the ends, which are rounded. Two of the rays of the triacts are much longer than the third, being on the average 25 μ by 125 μ, while the third ray is only 25 μ long although almost as thick as the longer rays at its base. Occasional triacts are found which lack the blunt spines. Very long interstitial smooth styles are also present. These are 27 μ by 400 μ minimum and probably much longer, as most of them are broken. Another type of spicule occasionally found is long, smooth, and wavy. This type is so regularly broken that its exact nature is difficult to determine, but it is at least 42 μ by 325 μ and appears to be stylote.

Holotype.—AHF no. 6.

Type locality.—South Bay, Cerros Island; Lat. 28° 05′ 20″ N, Long. 115° 18′ 40″ S; 24 m; rock close to kelp beds.

Distribution.—Same.

Material examined.—

Sta. 287-34 Cerros Island 3-10-34 25 m

Remarks.—This new species is very distinctive, being completely unlike the genotype, which has mostly tetractine spicules (instead of triactine spicules) with all rays of equal length. It is perhaps most like *Cyamon neon* of southern California, but that sponge had only the short ray of the triacts spined, and both triacts and tetracts which are often oxeote. *C. neon* is also a massive sponge without the peculiar surface specialization found on the new species. There are also numerous differences in spicule size.

Genus **TRIKENTRION** Ehlers

Trikentrion helium, new species

Plate 20, Figs. 39, 40

Diagnosis.—This sponge is 7 by 5 by 5 cm. It is made up of undulating or corrugated sheets, which are rather thin and attached at one edge. The texture is woody and somewhat brittle. The color in alcohol is drab throughout. A thick spicule brush covers the surface to a depth of 3 mm in many places.

There is a distinct surface layer 500 μ thick, but this is nondetachable, indicating a lack of extensive subdermal cavities. Occasional openings are found which average about 1 mm in diameter. These are probably oscules. The endosomal structure is decidedly firm and fleshy, and the gross cavities cannot be seen with the naked eye.

The chief spiculation consists of a mass of triacts, which have large spines on the short ray ony. The triact is about 250 μ long and 25 μ thick. The spined third ray averages 24 μ in length. The only other spicule type is a very long, thin oxea. These are 4 μ thick and reach a length of several mm.

Holotype.—AHF no. 7.

Type locality.—Cerros Island; Lat. 28° 05′ 20″ N, Long. 115° 18′ 40″ S; dredged from 20 fms in the bay.

Distribution.—Same.

Material examined.—

Sta. 287-34 Cerros Island 3-10-34 Shore

Remarks.—It is interesting to note that *Cyamon* and *Trikentrion* were found near each other in the Gulf of California. *Cyamon* is found in the West Indies but not *Trikentrion;* both *Trikentrion* and *Cyamon* are found in the East Indies. The California species of *Cyamon, C. neon,* is similar to *Trikentrion helium* but has only very small spines on the triacts, while this sponge has very large ones; and, most important, the California sponge has styles, while the Gulf specimen does not. *Trikentrion flabelliformis* has the large spines but also some monacts. It is probably the closest relative of the new species.

Family **Myxillidae** Hentschel

Genus **IOPHON** (Gray) de Laubenfels

Iophon indentatus Wilson

Plate 21, Figs. 41, 42; Plate 22, Fig. 43

Iophon lamella Wilson, 1904, p. 146.

Iophon indentatus Wilson, 1904, p. 151.

Diagnosis.—Specimens of this sponge are massive, brown in alcohol, and mediocre in consistency. Oscules about 1 mm in diameter are scattered over the surface of some specimens. No pores are evident to the naked eye. The endosomal structure is "bready."

The principal spicules are acanthostyles 13 μ to 17 μ by 300 μ to 333 μ. The ectosomal spicules are smooth tylotes with heads microspined; size 5 μ by 200 μ to 266 μ. Palmate anicochelas of the usual contort type about 13 μ long, and bipocillates 15 μ long are common in one of the specimens

which was collected in deep water. The other specimen has few microscleres. Occasional sigmas were found in one specimen, but these may not be proper.

Holotype.—U.S.N.M.

Type locality.—Gulf of California and west coast of Central America.

Material examined.—

Sta.	559-36	Isla Partida	3- 9-36	90 m
Sta.	560-36	Isla Partida	3- 9-36	140 m

Remarks.—Wilson, 1904, described two sponges from the west coast of Central America as *Iophon indentatus* and *Iophon lamella*. They were collected by the *Albatross* in 1891. As there is little to distinguish between the two and as both are from the same locality, *I. lamella* should be placed in synonymy with *I. indentatus*.

Other *Iophon* sponges reported are *I. chelifer* Lambe, 1893, which was reported from the west coast of Canada and again from southern California by de Laubenfels (variety California) and a variety of *I. chelifer* (ostiamagna) reported by Wilson, 1904, from the eastern tropical Pacific. All of these, together with *I. indentatus*, are very close together and are probably a single species.

Genus **MYXICHELA** de Laubenfels

Myxichela microtoxa de Laubenfels

Plate 22, Fig. 44; Plate 23, Figs. 45, 46

Diagnosis.—This sponge is a massive form of Myxilliidae. The surface is broken into a closely packed mass of protuberances, between which openings about 800 μ in diameter are occasionally to be seen. A surface membrane, if present, is not clearly defined. The color of the preserved specimen is drab throughout, and the consistency rather corklike. The surface is occasionally hispid to 100 μ.

The chief megascleres are acanthostyles which are exceptionally rough. They are 20 μ by 333 μ in average size. Dermal spicules are tylotes with heads microspined. The size of these spicules is most frequently 4 μ by 190 μ. There are no smooth styles. The microscleres are palmate chelas, which are rather consistently 15 μ long, and toxas, which have an average length of 135 μ.

Holotype.—AHF no. 8.

Type locality.—Between Angel de la Guardia Island and Isla Partida; 40 m; nullipores.

Distribution.—Same.

Material examined.—

Sta.	555-36	Angel de la Guardia Island	3- 8-36	40 m

Remarks.—This sponge is not close to any other member of the genus. The genotype *Myxichela tawiensis* is perhaps the nearest relative, but it has bipocilli and the toxas are more than twice as large. *Lepthoclathria hoplotoxa* is similar in the size of the microscleres and the same type of megascleres, although they are much smaller, but it is a thin encrusting sponge instead of massive.

Genus **MYXILLA** Schmidt

Myxilla mexicensis, new species

Plate 24, Figs. 47, 48; Plate 25, Figs. 49, 50

Diagnosis.—This sponge is massive, 10 cm by 7 cm by 6 cm, and amorphous. The color in alcohol is pinkish drab, the consistency mediocre. A distinct dermal membrane about 100 μ thick covers rather extensive subdermal cavities and is easily detachable. The surface of the sponge is superficially smooth. Occasional openings 3 mm in diameter and irregularly placed are found. The endosome is very coarse in microscopic structure.

Coring spicules are very small anchorate chelas, which are usually 12 μ but sometimes only 10 μ long. Sigmas are also present, as a rule about 14 μ in length. An occasional sigma 32 μ was found in one specimen, but these do not appear to be proper.

Holotype.—AHF no. 9.

Type locality.—Off San Francisco Island; 60 m; corallines.

Distribution.—Gulf of California.

Material examined.—

Sta.	513-36	San Francisco Island	2-24-36	60 m
Sta.	520-36	Agua Verde Bay	2-27-36	15 m
Sta.	607-36	San Lorenzo Channel	3-21-36	48 m
Sta.	642-37	Espiritu Santo Island	3- 8-37	55 m

Remarks.—All the sponges of the Myxillidae, which are massive, have megascleres that are very close to one another in type. They are distinguished as to genus by the combination of microscleres present (or absent) and as species largely by the size range of the spicules. It is on this basis that the above species is established. The microscleres are exceedingly small for their type for the *Myxilla.* In fact, they represent an extreme for the genus. *M. agennes* de Laubenfels, 1930, apparently the nearest relation, differs in having sigmas about 33 μ and chelas about 27 μ. This sponge is from California. *M. rosacea* Lieberkühn, 1859, has sigmas 49 μ and chelas 30 μ. In addition, the styles are spiny throughout their length instead of only on the head.

Family **Tedaniidae** Ridley and Dendy
Genus **TEDANIA** Gray
Tedania nigrescens (Schmidt)
Plate 26, Figs. 51, 52

Reniera nigrescens Schmidt, 1862, p. 64.
Tedania nigrescens Gray, 1867, p. 495.

Diagnosis.—Specimens of this sponge vary from massive to encrusting. In alcohol the color varies from almost black to drab. Oscules up to 5 mm in diameter are frequently present, although not always so. There is a dermal layer about 50 μ thick and nondetachable, although some specimens seem to lack the layer perhaps because of rough handling. As a rule, the surface is smooth, though in some specimens it is broken by protuberances especially around the oscules.

Principal spicules in specimens from the Gulf are styles averaging about 8 μ by 150 μ. Special dermal spicules are tylotes 4 μ by 200 μ. The microscleres are the characteristic roughened rhaphids (onychaetes) 1 μ to 2 μ by 140 μ.

Holotype.—British Museum.

Type locality.—Mediterranean.

Distribution.—World wide.

Materials examined.—

Sta.	598-36	Puerto Escondido	3-17-36	Shore
Sta.	631-37	La Paz Bay	3- 6-37	10 m
Sta.	639-37	Espiritu Santo Island	3- 7-37	10 m
Sta.	650-37	San Francisco Island	3- 9-37	90 m

Remarks.—*Tedania nigrescens* has been reported from James Island, Galapagos, and Magdalena Bay, Mexico, collected on the Presidential Cruise to these waters in 1938, and by the Hancock Pacific Expeditions from Albemarle Island in the Galapagos; also from Mexico and Central America.

Genus **ACARNUS** Gray
Acarnus erithacus de Laubenfels
Plate 27, Figs. 53, 54; Plate 28, Fig. 55

Acarnus erithacus de Laubenfels, 1927, p. 258.

Diagnosis.—This is a massive sponge, brilliant red in life and drab when preserved. Its spiculation is described as follows: "Ectosomal spicules, tylotes with heads microspined; size 3 μ by 185 μ to 4 μ by 175 μ. Interratitial spicules, cladotylotes, size 11 μ by 230 μ. Chords 35 μ. Coring spicules styles; size, 18 μ by 345 μ to 17 μ by 425 μ; these are the

most conspicuous elements. Echinating spicules acanthocladotylotes, size 3 μ by 80 μ, chords 11 μ and larger. First microscleres, palmate isochelas; length, 14 μ to 16 μ; second microscleres, toxas; length, 40 μ to 340 μ." (de Laubenfels, 1932, p. 104.)

Holotype.—U.S.N.M.

Type locality.—Pacific Grove, California.

Distribution.—Central and southern California, coast of Baja, California, and the Gulf of California.

Material examined.—

Sta. 1085-40	San Pedro Nolasco Island	2- 6-40	55 m

Remarks.—The Gulf specimen has a rather greater range in spicule length than the California specimens, the styles sometimes attaining a length of 800 μ, while the toxas show an even more amazing variation than those of the California specimens, reaching a maximum of 440 μ. There are many, however, which are in the size range of the holotype.

Genus **LISSODENDORYX** Topsent

Lissodendoryx isodictyalis Topsent

Plate 28, Fig. 56; Plate 29, Figs. 57, 58; Plate 30, Figs. 59, 60

Halichondria isodictyalis Carter, 1882, p. 285.
Tedania leptoderma Topsent, 1889, p. 49.
Lissodendoryx isodictyalis Topsent, 1894, p. 9.

Diagnosis.—This is a massive sponge, drab in alcohol, and soft in consistency. The surface is superficially smooth and oscules are prominent. A dermis is present about 10 μ thick. It overlies extensive subdermal cavities and contains special dermal spicules, which are tylotes averaging 4 μ by 175 μ. The interior mesh is made up of smooth styles 5 μ by 145 μ on the average. Arcuate isochelas 21 μ long and sigmas 18 μ long are the microscleres.

Holotype.—British Museum.

Type locality.—West Indies.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 500-36	Espiritu Santo Island	2-20-36	Shore
Sta. 1041-40	Guaymas Bay	1-23-40	Shore

Remarks.—This sponge has been reported from the West Indies, the Mediterranean, and the East Indies, as well as from the Gulf of California. The characteristics of specimens found in the Gulf follow very closely previously published descriptions.

Family **Raspailiidae** Hentschel

Genus **HEMECTYON** Topsent

Hemectyon hyle de Laubenfels

Plate 31, Figs. 61, 62; Plate 32, Figs. 63, 64

Hymectyon hyle de Laubenfels, 1930, p. 28.

Diagnosis.—This species has the characteristic ramose shape of the family. The echinating spicules are unusual-looking acanthostyles 12 μ by 180 μ and larger with only the sharp ends spined; coring spicules, styles averaging 18 μ by 480 μ, also some strongyles somewhat shorter, and rhaphids about 2 μ by 250 μ. There are some very long, thin spicules present which are so broken that their length cannot be determined.

Holotype.—U.S.N.M.

Type locality.—Point Fermin, California.

Material examined.—

Sta.	559-36	Isla Partida	3- 9-36	90 m
Sta.	618-37	San Jaime Bank	3- 3-37	150 m
Sta.	751-37	Los Frailes Bay	4- 4-37	30 m

Remarks.—The Gulf specimens of the species show considerable variation of spicule size, tending on the whole to have larger spicules than the specimens reported from southern California.

Hemectyon hymani, new species

Plate 33, Figs. 65, 66

Diagnosis.—This is a very beautiful, fan-shaped species. It is lacelike in appearance, and characteristic specimens are about 45 cm square and not over 3 or 4 mm thick at any point. It is rather stiff and woody in texture, and the surface is slightly hispid to the touch. The color in alcohol is light drab, almost white. Pores and oscules are not visible.

The spicules on the periphery of the sponge are erect and consist of acanthotylostyles averaging 6 μ by 130 μ. The echinating spicules are acanthostyles and acanthotylostyles 30 μ by 300 μ, the former being noteworthy because of a frequent right angle bend toward the head end. Coring spicules are smooth styles 36 μ thick and very long, but so broken that an actual length cannot be assigned. Microscleres are rhaphids size 2 μ by 150 μ.

Holotype.—AHF no. 10.

Type locality.—San Jaime Banks off Cape San Lucas, Mexico; Lat. 22° 50′ 30″ N, Long. 110° 15′ W; 150 m; old coralline algae.

Distribution.—Same.

Material examined.—

Sta.	618-37	San Jaime Bank	3- 3-37	150 m

Remarks.—This sponge is closely related to *Hemectyon hyle* de Laubenfels, which is found in the same region. It differs, however, by its distinctive form, which is very unlike the vaselike form of *H. hyle,* found in the same region. The spiculation is consistently about half as large, although we are undoubtedly dealing with a fully mature specimen. Should intermediate types, in form and spiculation, be discovered, it is possible that this species would fall in synonymy; but at present it seems more convenient to erect a new species for this distinctive group of specimens. Another possibility is that we are dealing with a series of stages in a complex life history or that this sponge has distinct male and female forms and that we have here one of the sexes of which *H. hyle* is the other.

Family **Microcionidae** Hentschel

Genus **HETERECTYA** Hallmann

Heterectya cerebella, new species

Plate 34, Figs. 67, 68

Diagnosis.—The preserved specimen of this sponge is drab in color. It is 3 cm by 2 cm by 2 cm and is made up of coalesced twisted columns 2 or 3mm in diameter, which give it the appearance of brain coral. The specimen is a fragment of a larger mass. The surface is finely grained, but ectosomal specialization is very vague. Two openings are visible on the specimen each about 4 mm in diameter. They are probably oscules.

The megasclere spiculation is typical of the genus with smooth styles 35 μ by 600 μ, which do not differ in the surface layer. The echinating spicules are peculiarly bent styles. The bending is sharp and occurs about one-fifth of the length from the head. The lower third of the spicule is is heavily spined. The average size is 30 μ by 400 μ. No microscleres are present.

Holotype.—AHF no. 11.

Type locality.—Off Isla Partida to the south; 90 m; sand bottom.

Distribution.—Same.

Material examined.—

Sta. 559-36	Isla Partida	3- 9-36	90 m

Remarks.—This is the only member of the genus so far reported from the Pacific coast. Its nearest relative appears to be *Raspailia inaequalis* Dendy, but this sponge has oxeas as well as styles for dermal spicules. It should be transferred to *Echinaxia.* It is interesting to note that the specimen of *Heterectya* was full of worms of various kinds.

Genus **ISOCIONA** Hallmann

Isociona lithophenix de Laubenfels

Plate 35, Figs. 69, 70; Plate 36, Figs. 71, 72

Plocamia lithophenix de Laubenfels, 1927, p. 263.
Isociona lithophenix de Laubenfels, 1932, p. 99.

Diagnosis.—This sponge has a vague sort of ectosomal specialization. The endosome is an isodictyal reticulation. The principal spicules are acanthostyles to acanthostrongyles 14 μ by 140 μ. The dermal spicules are smooth tylostyles 5 μ by 200 μ. A few smooth styles 10 μ by 210 μ and some acanthostyles 15 μ by 150 μ are also found. The palmate isochelas are typically 17 μ to 21 μ. The toxas in the Gulf specimens sometimes reach the length of 260 μ but average around 180 μ.

Holotype.—U.S.N.M.

Type locality.—Pacific Grove, California.

Distribution.—Central and southern California and the Gulf of California.

Material examined.—

Sta.	542-36	Puerto Refugio	3- 4-36	50 m
Sta.	559-36	Isla Partida	3- 9-36	90 m
Sta.	562-36	San Esteban Island	3-10-36	90 m

Remarks.—The toxas found in specimens from the Gulf are somewhat larger than those found in specimens from southern and central California, but this is not an especially significant difference. This *Isociona* is the only member of the genus other than the genotype.

Family **Ophlitospongiidae** de Laubenfels

Genus **MYCALE** Gray

Mycale angulosa (Duchassaing and Michelotti)

Plate 37, Figs. 73, 74; Plate 38, Figs. 75, 76

Pandaros angulosa Duchassaing and Michelotti, 1864, p. 89.
Hircinia purpurea Whitfield, 1901, p. 49.
Mycale angulosa de Laubenfels, 1936, p. 116.

Diagonsis.—This is a massive sponge with large cavities and a generally coarse gross architecture. It has a densely packed fiber mass ascending to a fan-shaped surface structure. The spicules are tylostyles sometimes only sub; size 2 μ by 200 μ. The palmate anisochelas are 14 μ to 20 μ and the sigmas 42 μ to 45 μ.

Holotype.—Msueum of the University of Turin.

Type locality.—West Indies.

Distribution.—This sponge has been described from the West Indies and from the Gulf of California as just noted. It has also been described from Australia, but the Australian specimen is certainly not conspecific.

Material examined.—

Sta. 1039-40 Guaymas Bay 1-23-40 10 m

Remarks.—The specimen mentioned above is remarkably close to previously published descriptions. The California member of this genus, *M. bellabellensis* Lambe, has much larger chelas than *M. angulosa.* It has, moreover, very few, if any, sigmas. It is probable that several *Mycale* should be synonomized where the differences are in the size ranges of the chelas alone.

Genus **CARMIA** Gray

Carmia contax, new species

Plate 39, Figs. 77, 78; Plate 40, Figs. 79, 80; Plate 41, Fig. 81

Diagnosis.—This sponge is about 2 square cm by .5 cm thick. The surface is irregular, the consistency is softly spongy, pores and oscules are not evident.

A special dermal membrane, very thin and detachable, is found in places. This is filled with spicules in confusion. The general endosomal structure is bready with occasional fibers.

The principal spicules are styles to subtylostyles; size 7 μ by 300 μ. Dermal and interstitial spicules tylostyles; size 3 μ by 240 μ. There are three size categories of palmate anisochelas: first, 6 μ to 7 μ; second, 14 μ to 16 μ; third, 21 μ to 23 μ. This triple range of anisochelas is rather typical of *Mycale* and *Carmia.* Other microscleres are sigmas 75 μ and 18 μ long, toxas averaging 55 μ, and some rhaphids 2 μ by 150 μ.

Holotype.—AHF no. 12.

Type locality.—Los Frailes, Lower California; 20 m; sand and algae bottom.

Distribution.—Same.

Material examined.—

Sta. 751-37 Los Frailes 4- 4-37 20 m

Remarks.—This species differs from its nearest relative, *C. contarenii* Martens, 1824, chiefly in the very small size of the sigmas and in the peculiarly shaped heads on the tylostyles of *C. contarenii,* which, while definitely tylotes, may be smaller than the thickest part of the shaft, and show a trilobate structure. *C. contarenii* also has trichodragmas and no toxas. It should be transferred to *Mycale* for this reason. It is found off England and in Mediterranean waters.

Carmia fascifibula (Topsent)

Plate 41, Fig. 82; Plate 42, Figs. 83, 84

Esperella fascifibula Topsent, 1904, p. 210.
Mycale fascifibula de Laubenfels, 1932, p. 70.
Carmia fascifibula de Laubenfels, 1936, p. 118.

Diagnosis.—The specimen of this sponge from the Gulf of California is greenish white in alcohol and cartilaginous in consistency. There is a distinct ectosome 100 μ thick, which is detachable and covers subdermal cavities. Openings about 65 μ in diameter can be made out. These are probably pores. No oscules were found on this specimen.

The dermal spicules are tylostyles 10 μ by 450 μ to 500 μ. The principal spicules are styles of the same size. It is difficult to distinguish the two categories, as they are the same size and the tylote modification has every intermediate grade.

The microscleres are two ranges of palmate anischelas 50 μ and 20 μ to 22 μ, sigmas about 250 μ long and 50 μ to 60 μ wide, as well as trichodragmas and toxas.

Holotype.—Paris.

Type locality.—Azores.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 557-36 Isla Partida 3- 8-36 90 m

Remarks.—The double-headed tylostyles mentioned in the original description do not seem to be present in this specimen; otherwise, it agrees precisely.

Genus **MICROTYLOSTYLIFER** Dendy

Microtylostylifer partida, new species

Plate 43, Figs. 85, 86; Plate 44, Fig. 87

Diagnosis.—The consistency of this sponge is corklike, the color drab throughout. It is very heavily hispidated. The average length of the protruding spicules is more than 3 mm. Protuberances about 3 mm high by 2 mm at the base are visible through the spicule plush. There are twenty of them on the specimen.

A distinct cortical layer, about 600 μ thick, is present. It is very closely held. Pores and oscules, if present, are not visible because of the very heavy spicule brush. A cross section of the specimen shows it to be fleshy with gross cavities averaging 300 μ.

Three types of megascleres are present. The dermal spicules are peculiar tylostyles, which have a much thickened shaft. The central

portion of the shaft is thicker than the noblike ends. The same is true to a lesser extent with the styles, which are coring. These spicules are rather thick toward the center but taper to the rounded end. The third megasclere is a thin, exceedingly long spicule, probably an oxea. These are 30 μ thick. Just how long they are is not possible to say, as they are much broken; but they extend at least 4 or 5 mm.

The trichodragma modification is present in the microscleres. Tylostyles 100 μ to 150 μ long and 1 μ to 2 μ thick are the microscleres.

Holotype.—AHF no. 13.

Type locality.—West of Isla Partida, Lower California, Mexico; 140 m; rock bottom.

Distribution.—Same.

Material examined.—

Sta.	560-36	Isla Partida	3- 9-36	140 m

Remarks.—No other member of this genus appears to have been reported from the Pacific coast. The type of the genus is Australian. It appears to be the nearest relative, but the spicule sizes do not at all correspond.

Family **Amphilectidae** de Laubenfels

Genus **BIEMNA** Gray

Biemna rhadia de Laubenfels

Plate 44, Fig. 88; Plate 45, Fig. 89

Biemna rhadia de Laubenfels, 1930, p. 26.

Diagnosis.—The specimen of this sponge is 6 cm by 4 cm by 2 cm, color in life drab, consistency mediocre. Occasional oscules 2 mm in diameter are present. The endosomal structure is mostly confused but shows occasional tracts.

The principal spicules are styles 25 μ by 500 μ to 28 μ by 1500 μ. The most usual size is 28 μ by 750 μ. There is a tremendous range of sigmas, 20 μ to 400 μ in length. Rhaphids 1 μ by 150 μ are also present.

Holotype.—U.S.N.M.

Type locality.—Monterey Bay, California.

Distribution.—Central California to the Gulf of California.

Material examined.—

Sta.	557-36	Isla Partida	3- 8-36	90 m

Remarks.—The California specimens of this sponge do not differ materially, but they do not shows quite the size range of spicules that is found in the Gulf specimens.

Order HALICHONDRINA Vosmaer
Family Axinellidae Ridley and Dendy
Genus AXINELLA Schmidt
Axinella mexicana de Laubenfels
Plate 45, Fig. 90; Plate 46, Figs. 91, 92

Axinella mexicana de Laubenfels, 1935, p. 6.

Diagnosis.—The Hancock specimen of this sponge is 4 cm by 3 cm by 3 cm, very hispid, and woody in consistency. Pores 800 μ and oscules 5 mm in diameter are abundant. In alcohol the color is light, almost white. Great plumose tracts are evident in the endosome even to the naked eye.

The principal spicules are oxeas 20 μ by 300 μ to 28 μ by 500 μ, averaging 25 μ by 465 μ. Styles 25 μ by 400 μ and less are also found. Both types are almost always sharply bent. There are no microscleres.

Holotype.—American Museum of Natural History.

Type locality.—Lower California.

Distribution.—Lower California and Gulf of California.

Material examined.—

Sta.	560-36	Isla Partida	3- 9-36	140 m

Remarks.—The fact that the oxeas exceed the styles in average length is rather unusual.

The Gulf specimens of this sponge do not differ in any particular from specimens originally described.

Genus DRAGMACIDON Hallmann
Dragmacidon opisclera de Laubenfels
Plate 47, Fig. 93, 94; Plate 48, Fig. 95

Dragmacidon opisclera de Laubenfels, 1935, p. 7.

Diagnosis.—Specimens of this sponge are drab in alcohol, cartilaginous in consistency, and only slightly hispid. The chief spicules are styles 22 μ by 400 μ to 35 μ by 700 μ or larger. The oxeas have about the same range but average shorter. Very thin, sinuous spicules are also present, ½ μ to 2 μ thick and sometimes as long as 500 μ. The trichodragma modification is found in some specimens. All spicules are bent.

Holotype.—American Museum of Natural History.

Type locality.—Lower California.

Distribution.—Lower California and the Gulf of California.

Material examined.—

Sta.	542-36	Puerto Refugio	3- 4-36	50 m
Sta.	556-36	Isla Partida	3- 8-36	60 m
Sta.	557-36	Isla Partida	3- 8-36	90 m
Sta.	750-37	Outer Gorda Bank	4- 4-37	10 m
Sta.	1081-40	Isla Partida	2- 5-40	75 fms

Remarks.—There seems to be more overlapping in the size ranges of the styles and oxeas in the Gulf specimens than in the specimens from the Pacific side.

Genus **THIELEIA** Burton

Thieleia rubiginosa (Thiele)

Plate 48, Fig. 96; Plate 49, Fig. 97

Hymeniacidon rubiginosa Thiele, 1905, p. 421.
Thieleia rubiginosa Burton, 1932, p. 329.

Diagnosis.—Gulf specimens of this sponge are drab and cartilaginous. The surface is conulose with oscules up to 2 mm in diameter often located on the cones. The endosome is drab and "bready." There is some evidence of vertical structure, and the oscules open into cavities which often go completely through the sponge.

The only spicules are styles most typically 9 μ by 300 μ but with variations plus and minus.

Holotype.—British Museum.

Type locality.—West coast of South America.

Distribution.—West coast of South America to the Gulf of California.

Material examined.—

Sta.	552-36	Angel de la Guardia Island	3- 6-36	Shore
Sta.	553-36	Pond Island	3- 8-36	Shore

Remarks.—The cloacal-like cavities running through these specimens, while not unique for the family, are unusual for the genus.

Genus **HIGGINSIA** Higgin

Higginsia higginissima, new species

Plate 49, Fig. 98; Plate 50, Figs. 99, 100; Plate 51, Fig. 101

Diagnosis.—This sponge is coral pink in alcohol. It is composed of stocklike growths fused together into a mass. Its consistency is cartilaginous. There is much infiltrated sand in the specimen, and the surface is so caked and imbedded that the pores and oscules cannot be located properly. The size is 7 cm by 5 cm by 4 cm.

The principal megascleres are oxeas which average in size about 12 μ by 600 μ. There is considerable variation, however, and occasionally oxeas up to 20 μ by 1,800 μ are found. The second megascleres are smooth styles. These are rather rare. They have the same general measurements as the oxeas, although they do not attain quite the extremes in size.

The first microscleres are spined strongyles which are often sharply bent at the center. The typical size is 3 μ by 90 μ. The second microscleres

are spined centrotylotes, bent at the central knob. The third microsclere is a smooth, straight centrotylote about 2 μ by 21 μ. The spiny centrotylotes are intermediate in size between the first and third type.

Holotype.—AHF no. 14.

Type locality.—San Lorenzo Channel, Espiritu Santo Island; 48 m; bottom of coralline.

Distribution.—Same.

Material examined.—

Sta.	607-36	Espiritu Santo Island	3-21-36	48 m

Remarks.—*H. papillosa* Thiele, 1905, is a close relative of this sponge. It was reported on the Presidential Cruise of 1939 by de Laubenfels, 1939, from Albemarle Island, Galapagos, and it was originally described from Chile. It, however, does not have the centrotylotes either smooth or spiny and has instead sharply bent spiny tornotes.

Family **Halichondriidae** Gray
Genus **HALICHONDRIA** Fleming
Halichondria panicea (Pallas)
Plate 51, Fig. 102; Plate 52, Fig. 103

Spongia panicea Pallas 1766, p. 388.
Halichondria panicea Johnston, 1842, p. 114.

Diagnosis.—This is an encrusting sponge, white in alcohol, orange in life, with a smooth surface. The ectosomal specialization is strongly marked. There is a dermal layer 150 μ to 200 μ thick containing tangentially placed spicules. The endosome has the same spicules in confusion. These spicules are oxeas 12 μ by 245 μ to 15 μ by 250 μ.

Holotype.—Unknown.

Type locality.—Europe.

Distribution.—Cosmopolitan.

Material examined.—

Sta.	519-36	San Francisco Island	2-26-36	Shore
Sta.	549-36	Angel de la Guardia Island	3- 6-36	80 m

Remarks.—This sponge is common in European waters and is found along the California coast as well as in the Galapagos Islands.

Family **Semisuberitidae** de Laubenfels
Genus **RHAPHOXYA** Hallmann
Rhaphoxya laubenfelsi, new species
Plate 52, Fig. 104

Diagnosis.—The color of this sponge in alcohol is light green throughout. The general shape is ramose, much like tree coral, with an over-all

size of 8 cm by 6 cm by 6 cm. The surface is conulose, and the end of each branch has an oscule 2.5 mm in diameter.

There is a definite surface membrane over cavities, which is detachable. The endosome is rather plumose in structure. Ascending fibers average 400 μ in diameter, and project at the surface about 3 mm. They are 3 mm apart. The amount of spongin present is not large.

The principal spicules are curved or sinuous oxeas 16 μ to 24 μ by 650 μ. Styles, bent at right angles, are also present. These are usually 16 μ by 500 μ to 550 μ. There exist interstitially some much broken spicules 2 μ to 4 μ by 300 μ plus or minus. These may be termed rhaphides.

Holotype.—AHF no. 15.

Type locality.—San Gabriel Bay, Espiritu Santo Island; from the shore; coral.

Distribution.—Same.

Material examined.—

Sta.	634-37	Espiritu Santo Island	3- 6-37	60 m

Remarks.—The nearest relative of this sponge seems to be *Acanthella stipitata* Carter, which is from Australia, but this does not have the bent styles. It is also globular instead of ramose and does not have the rhaphids. *Rhaphoxya pallida* Dendy, 1897, has strongyles and trichodragmas while lacking the bent styles and sinuous oxeas. It is also from Australia.

R. typica Hallmann, the genotype, is very like *R. pallida* but has its membrane over cavities instead of nondetachable. They are probably synonomous, especially as both come from Australia. *R. mollis* Thiele from the west coast of South America is also close to the genotype but not to the Gulf species.

Our species is typical for *Rhaphoxya* in that no trichodragma are found. However, it fits closely in all other respects, and trichodragmas are not part of the genus description.

This species is named in honor of M. W. de Laubenfels, friend, adviser, and teacher of the author.

Family **Hymeniacidonidae** de Laubenfels

Genus **ADREISSA** Topsent

Adreissa letra, new species

Plate 53, Figs. 105, 106; Plate 54, Figs. 107, 108

Diagnosis.—This sponge is crisp in consistency. It is about 10 cm long, 8 cm wide, and 2 cm thick, and is laminate. In alcohol the color is light drab, almost white. The surface is smooth to the touch but irregular. There are numerous openings from 2 mm to 5 mm in diameter. Pores are

abundant and average 150 μ in diameter. There is a very tough membrane present over cavities. This membrane contains no spicules.

The specimen, as is typical of *Adreissa,* has only styles. These are 40 μ by 2,000 μ in the flesh, with smaller ones organized in the tract.

Holotype.—AHF no. 16.

Type locality.—San Jaime Banks, off Cape San Lucas; Lat. 22° 50′ 30″ N, Long. 115° 15′ W; 240 m; granite rocks on the bottom.

Distribution.—Same.

Material examined.—

Sta.	619-37	San Jaime Bank	3- 3-37	240 m

Remarks.—No other member of this genus has such enormous styles; and, while the extreme simplicity and consequent similarity of species here placed make many species seem unnecessary, still this represents an extreme without intermediates and therefore justifies the erection of a new species.

Genus **HYMENIACIDON** Bowerbank

Hymeniacidon adreissiformies, new species

Plate 55, Figs. 109, 110; Plate 56, Fig. 111

Diagnosis.—This specimen is tan in color when preserved in alcohol. It is cartilaginous in consistency and appears to be a fragment of a larger encrusting mass.

There is a distinct cortical layer which averages 100 μ in thickness. This is semidetachable, and there are subdermal cavities. The specimen is not hispid. The surface has many craterlike structures irregularly placed, some of which contain oscules. There are about 35 oscules on the fragment, which range in size from 1 mm to 4 mm. Many ascending canals are present, which give the cross section of this sponge the appearance of vertical structure.

The only spicule type is a smooth style, which is abundant and strewn in considerable confusion throughout the flesh. The styles are peculiar in their very abrupt, rounded ends, which give the appearance in some instances of being cleanly cut away. Indeed, that was the first impression recorded when the specimen was examined, but closer study revealed that all the spicules were of the same length, whether rounded or sharply truncated. The pointed end of these styles approaches the tornote modification.

Holotype.—AHF no. 17.

Type locality.—Middle San Benito, Lower California, Mexico; from the shore.

Distribution.—The same.

Material examined.—

Sta. 609-36 San Benito 3-24-36 Shore

Remarks.—The canals found in this sponge give it the superficial appearance of being organized into tracts. If this were true, it might be placed in the genus *Adreissa.*

The peculiar modification of the styles is unique for the genus.

Hymeniacidon sinapium de Laubenfels

Plate 56, Fig. 112

Hymeniacidon sinapium de Laubenfels, 1930, p. 26.

Diagnosis.—This sponge is typical of the family and genus, having a thin fleshy dermis and an endosomal structure in which the spicules are mostly in confusion, although occasional vague tracts, made up of styles points upward, are found.

The sole type of spicule is a style size 9 μ by 350 μ.

Holotype.—U.S.N.M.

Type locality.—Newport Bay, California.

Distribution.—Southern California to the Gulf of California.

Material examined.—

Sta. 1041-40 Guaymas Bay 1-23-40 Shore

Remarks.—In the California specimens the styles are about a third larger on the average than in the Gulf specimens.

Genus **OXEOSTILON** Ferrer-Hernandez

Oxeostilon oxeon, new species

Plate 57, Figs. 113, 114; Plate 58, Figs. 115, 116

Diagnosis.—This sponge is 3 cm by 2 cm by 1 cm, drab when preserved, and corklike in consistency. The surface is covered with peculiar hornlike protuberances. These are 2 mm high and about 1 mm at the base. A distinct surface membrane is present, although it is less than 100 μ thick. It is easily detachable and there are extensive subdermal cavities. On areas which retain the surface membrane no pores or oscules are visible, but when the membrane has been lost, openings 1 mm in diameter, which form grooves on the exposed surface appear. Often the openings merge into one another.

The megascleres show great variety in size and are frequently bent or curved. Both oxeas and styles are present. Representative measurements are 30 μ by 600 μ, 40 μ by 800 μ, and 40 μ by 900 μ. The styles and oxeas are, in general, about the same size but occasionally oxeas were

found 35 μ by 1,000 μ and 50 μ by 1,150 μ or more. Microscleres are lacking, but peculiar lenslike silicon masses were found in one specimen. These were 20 μ on the long axis.

Holotype.—AHF no. 18.

Type locality.—West of Isla Partida; 140 m; rock bottom.

Distribution.—Gulf of California.

Material examined.—

Sta.	560-36	Isla Partida	3- 9-36	140 m
Sta.	562-36	San Esteban Island	3-10-36	100 m

Remarks.—*O. annandalei* Ferrer-Hernandez, 1923, the genotype, was found in Spanish waters. This, however, had forklike endings on some spicules, while others were faintly polytylote. A typical spicule size is 12 μ by 400 μ.

A specimen of the new species was also found at James Island, Galapagos.

Oxeostilon burtoni de Laubenfels

Plate 59, Fig. 117

Oxeostilon burtoni de Laubenfels, 1934, p. 15.

Diagnosis.—This is a massive sponge. The Gulf specimens are about 7.5 cm by 5 cm by 5 cm and still retain a coral pink color in alcohol at least on part of the surface. There is a thin surface membrane over large cavities and pore areas. The pores are very irregular in size, averaging perhaps 1 mm in diameter. There is a very slight hispidation in places.

The spicules are variable in size, but common measurements are 280 μ by 18 μ for styles and 320 μ by 10 μ for oxeas.

Holotype.—U.S.N.M.

Type locality.—West Indies.

Distribution.—West Indies and Gulf of California.

Material examined.—

Sta.	1097-40	Puerto Escondido	2-11-40	18 m

Remarks.—The spicules found in the Gulf specimens of this sponge are somewhat smaller than those reported for the holotype.

Order HADROMERINA Topsent

Family **Choanitidae** de Laubenfels

Genus CHOANITES Mantell

Choanites mineri de Laubenfels

Plate 59, Fig. 118; Plate 60, Figs. 119, 120; Plate 61, Fig. 121

Choanites mineri de Laubenfels, 1935, p. 10.

Diagnosis.—This sponge is fairly typical of the genus. "The megascleres are of one sort only—tylostyles—approximately 10 μ by 345 μ, the

erect dermal ones being the same size as those of the endosome. Among them is an abundance of microscleres, which abundance is very uncommon in the order Hadromerina. These are quite typical of the genus *Choanites,* being centrotylote microstrongyles. The typical size is 2 μ by 30 μ; some are as small as 1 μ by 18 μ and a few as large as 3 μ by 36 μ." (de Laubenfels 1935, p. 10.)

Holotype.—American Museum of Natural History.

Type locality.—Lower California.

Distribution.—Lower California and Gulf of California.

Material examined.—

Sta.	579-36	San Marcos Island	3-14-36	20 m
Sta.	1048-40	Puerto Refugio	1-26-40	Shore

Remarks.—This sponge was originally collected from the Pacific side of Lower California.

The specimens from the Gulf follow the description of the holotype very closely, although the spicules of both classes tend to range rather smaller than the spicules of the specimen from the west coast.

DELAUBENFELSIA, new genus

Diagnosis.—This genus is established for a sponge which corresponds closely in general architecture with the type of the family, but which possesses the unique microscleres described below.

Type species.—*Delaubenfelsia raromicrosclera.*

Remarks.—This genus is named in honor of the foremost living authority on the Porifera, M. W. de Laubenfels.

Delaubenfelsia raromicrosclera, new species

Plate 61, Fig. 122; Plate 62, Figs. 123, 124; Plate 63, Figs. 125, 126

Diagnosis.—Specimens of this sponge are dull drab in alcohol, stiffly spongy in consistency, and superficially smooth.

Six specimens were collected, all of which may have been torn from the same mass. The specimen from which the slides were made is 6 cm by 6 cm by 4 cm. There is a tough cortex about 1 mm thick, which is detachable only with difficulty. The pores are not visible to the naked eye but oscules 2 mm or 3 mm in diameter are occasionally found. The general form appears to be cakelike and probably developed from a spherical or subspherical form much as does *Geodia mesotriaena* on the California coast.

The gross endosome is quite solid with only very fine cavities. There is evidence of radial structure.

The microscopic structure shows a plumose development with tracts of tylostyles pointing upward. Deep in the sponge the tracts are as much as 160 μ in diameter, perhaps larger. Near the surface these break up into smaller tufts about 30 μ in diameter and protrude slightly from the surface.

The megascleres are tylostyles with well-developed heads at least twice the diameter of the shaft. Occasionally they show the double tylote modification. The average size is 10 μ to 12 μ by 380 μ. One was found that was 12 μ by 810 μ, while a few juveniles only 5 μ by 210 μ are to be found. The great majority, however, are very near the average.

The microscleres are unique. They are long and sinuous. They might be termed spirasters with a strongylote modification on the spines if we enlarged the term spirasters to include curvature only in one plane or nearly in one plane such as occurs in toxas. They might be termed spiny toxas except that there are always two distinct curvatures, sometimes three or four, instead of one. Furthermore, the spines are very large; indeed, they are often fully the size of the main shaft and not tapering. Another peculiarity is the branching, which is common near one or both ends, usually at the apex of a curve. These branches commonly have an enlarged end. Perhaps the best term to apply would be strongylote toxasters, although one should keep in mind that the curvature is not confined to the simple one of a toxa but is often multiple. The microscleres are located throughout the sponge and vary from 18 to 40 μ in length.

Holotype.—AHF no. 19.

Type locality.—Outside Concepcion Bay, Lower California, Mexico; 24 m; corallines.

Distribution.—Same.

Material examined.—

Sta. 683-37	Concepción Bay	3-15-37	24 m

Remarks.—This genus resembles *Spheciospongia* in the tendency to grow into a cakelike mass. There is some evidence of relationship also, to *Alcyospongia india* de Laubenfels from the West Indies. This genus, however, has a distinct stalk, is spherical, and has oxeas instead of tylostyles. The microscleres are spiny rhabds, which are not curved.

Choanites mineri is somewhat similar, having the tylostyles of approximately the same size and the same general architecture. The microscleres, however, are centrotylote microstrongyles, usually microspined. They look nothing like the microscleres of this new species. Numerous other genera of this family have peculiar microscleres but none which approach those of this species.

Genus **SPIRASTRELLA** Schmidt

Spirastrella coccinea (Duchassaing and Michelotti)

Plate 64, Figs. 127, 128; Plate 65, Figs. 129, 130

Thalysias coccinea Duchassaing and Michelotti, 1864, p. 84.
Spirastrella coccinea de Laubenfels, 1936, p. 143.

Diagnosis.—This specimen is very heavily loaded with minute lumps of what appear to be coral fragments. These are incorporated into the body of the sponge. The color in life is not recorded, but in alcohol it is almost white. The surface is very irregular. There is a cortex which is not easily detached. It is about 100 μ thick.

The megascleres are tylostyles 340 μ by 10 μ. They are frequently in bundles or in tracts that cross and recross, giving, under favorable conditions, a netlike appearance to the endosome. Microscleres are typical spirasters 20 μ to 25 μ long.

Holotype.—Museum of the University of Turin.

Type locality.—West Indies.

Distribution.—West Indies and the Gulf of California.

Material examined.—

Sta. 1040-40	Guaymas Bay	1-23-40	Shore

Remarks.—This species is fairly common in the West Indies and has been reported from the Mediterranean, although the Mediterranean form is probably not conspecific, unless all members of this genus, which is widely distributed, are considered so closely related as to be synonymous.

Family **Suberitidae** Schmidt

Genus **ATERGIA** Stephens

Atergia corona, new species

Plate 66, Figs. 131, 132; Plate 67, Fig. 133

Diagnosis.—The specimens of this sponge collected range in size from 2 cm to 5 cm in diameter and are frequently roughly globular. They are decidedly hispid up to 5 mm. Pores and oscules are not usually visible through the spicule plush, but occasionally a conule surmounted by an oscule occurs. The consistency is rather brittle.

There is a distinct brittle surface layer over extensive cavities, while the body of the sponge is coarse and "bready" to fibrous. The megascleres consist of two size ranges of tylostyles. The dermal spicules are erect tylostyles about 5 μ by 160 μ. There are also interstitial tylostyles of the same size range in radiating groups. The coring spicules are much larger tylostyles 20 μ by 1,500 μ to 2,000 μ, in which the tylote modification is not at the end of the spicule. Some small oxeas, which may be regarded either as microscleres or as small megascleres, are also present. These are 2 μ by 60 μ. They are frequently in fan-shaped masses or rafts.

Holotype.—AHF no. 20.

Type locality.—San Jaime Bank off Cape San Lucas; Lat. 22° 50′ 30″ N, Long. 110° 15′ W; 150 m; old coralline algae, granite rock.

Distribution.—Same.

Material examined.—

Sta. 618-37 San Jaime Bank 3- 3-37 150 m

Remarks.—This is a new genus to the Pacific Coast. The new species is typical of the genus, but no other species approaches it in spicule size.

Genus **LAXOSUBERITES** Topsent

Laxosuberites rugosus (Schmidt)

Plate 67, Fig. 134; Plate 68, Figs. 135, 136

Suberites rugosus Schmidt, 1868.

Laxosuberites rugosus Topsent, 1896.

Diagnosis.—The Gulf of California specimen of this sponge is an incrustation 1 cm thick and about 6 cm square. It is white in alcohol, fairly smooth on the surface, and has numerous cones about 5 mm high by 1 cm at the base irregularly placed. Each cone is surmounted by a closed oscule. When the surface is cut away, very regular passages 1 mm in diameter and perhaps 2 mm apart are found leading vertically. When the sponge is cut, this gives the edge an appearance of very regular vertical structure.

The spicules are styles to tylostyles, which at the surface are arranged in tufts, point upward. Typical measurements for our specimen are 120 μ by 6 μ and 260 μ by 8 μ. Those of the holotype are described as 175 μ to 375 μ and about the same thickness as ours.

Holotype.—Paris.

Type locality.—Mediterranean.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 552-36 Angel de la Guardia Island 3- 6-36 Shore

Remarks.—The sponge, which is provisionally identified as *Laxosuberites rugosus,* has a genotype originally from the Mediterranean. There is little difference between members of this genus, and *L. rugosus* may easily embrace all of the species.

Laxosuberites zeteki de Laubenfels

Plate 69, Figs. 137, 138; Plate 70, Fig. 139

Laxosuberites zeteki de Laubenfels, 1936, p. 450.

Diagnosis.—The Gulf specimen of this sponge is massive and resembles in gross structure a mass of giant fingers fused. The ends of the "fingers" protrude and give the surface a lumpy appearance. The color is bright

yellow. A typical specimen is 20 cm thick and at least 10 cm square, and is apparently a part of a larger mass. At the surface it is colored a dull green by foreign material. Oscules and pores are not evident. The endosome contains numerous canals 2 mm or 3 mm in diameter which tend to run vertically. The sole spicule type is a tylostyle which varies from 2 μ by 540 μ to at least 20 μ by 840 μ. The spicules are in confusion except for bunches placed points upward at the surface.

Holotype.—U.S.N.M.

Type locality.—Balboa, Canal Zone.

Distribution.—Both ends of Panama Canal and the Gulf of California.

Material examined.—

Sta. 1041-40	Guaymas Bay	1-23-40	Shore

Remarks.—This sponge agrees exactly with the published description of specimens from Panama even to the greenish algae deposits on the surface.

Genus **PSEUDOSUBERITES** Topsent

Pseudosuberites pseudos, new species

Plate 70, Fig. 140; Plate 71, Figs. 141, 142; Plate 72, Fig. 143

Diagnosis.—The specimens of this sponge are chocolate brown in color. There is a distinct cortex, semidetachable and about 400 μ thick. Pits or cones about 3 mm in diameter and about the same distance apart are found in a regular pattern on the surface. These may be closed oscules. No openings are visible. There is no hispidation.

Gross internal structure is very coarse and, like the surface, cartilaginous in consistency. Smooth tylostyles are the only spicules. Those of the endosome are a confused mass with typical measurements 10 μ by 330 μ, 8 μ by 270 μ, and 10 μ by 300 μ. In the special dermal layer, the spicules, while very like those of the endosome, are arranged in a tangential layer. They also tend to be somewhat thinner. A typical size is 6 μ by 330μ.

Holotype.—AHF no. 21.

Type locality.—Pond Island, Lower California, Mexico; from the shore of the lagoon.

Distribution.—Same.

Material examined.—

Sta. 547-36	Angel de la Guardia Island	3- 5-36	2 m
Sta. 553-36	Pond Island	3- 8-36	Shore
Sta. 1076-40	Tepoca Bay	2- 3-40	11 m
Sta. 1088-40	Ensenada de San Francisco	2- 7-40	2 m

Remarks.—*P. melanos* de Laubenfels, 1934, from the West Indies has spicules 10 μ by 200 μ, but this sponge is black and rather digitate.

Pseudosuberites hyalina (Ridley and Dendy)

Plate 72, Fig. 144; Plate 73, Fig. 145

Hymeniacidon hyalina Ridley and Dendy, 1887, p. 168.
Pseudosuberites hyalina Topsent, 1896, p. 127.

Diagnosis.—Since this sponge is the type of the genus, its description is covered by the genus diagnosis. Its spicules are up to 26 μ by 1,200 μ and perhaps larger.

Holotype.—British Museum.

Type locality.—West coast of Chile.

Distribution.—Cosmopolitan.

Material examined.—

Sta.	650-37	San Francisco Island	3- 9-37	94 m

Remarks.—This sponge is common in the Mediterranean.

Order EPIPOLASIDA Sollas
Family **Sollasellidae** Lendenfeld
Genus **EPIPOLASIS** de Laubenfels
Epipolasis oxyspicula, new species

Plate 73, Fig. 146; Plate 74, Figs. 147, 148

Diagnosis.—In alcohol this sponge is an intense black on the surface and a dark gray color within. The specimen is 11 cm by 9 cm by 3 cm. The shape is massive. The consistency is about that of hard rubber. The surface is hispid in patches about 500 μ. The larger areas are superficially smooth, but the spiculation may have been rubbed off. The ectosomal specialization probably consists only in a concentration of pigment cells at the surface. This black surface shades gradually into the gray of the endoderm so that a definite thickness cannot be assigned.

No openings are found in the undamaged areas of the sponge surface.

The spicules are arranged so that a definite radial structure is noticeable, although nothing of the nature of tracts can be established.

The spicules are oxeas and show great variability in size, but there are two definite size ranges. The first of these is most characteristically 40 μ by 2,000 μ. The second type tends to be dermal and erect. These are on the average 4 μ by 100 μ.

Holotype.—AHF no. 22.

Type locality.—Port Escondido, Mexico; from a shore of rock shingle.

Distribution.—Same.

Material examined.—

Sta.	591-36	Port Escondido	3-16-36	Shore

Remarks.—The nearest relative of this sponge appears to be *E. angulospiculata* from the Gulf of Mexico, which, however, has a bright yellow endosome. The larger spicules are strongyloxeote at one end or at both ends. The smaller spicules are also much larger than the corresponding category in the new species, while the larger range is considerably shorter.

Family **Tethyidae** Gray
Genus **TETHYA** Lamarck
Tethya aurantia (Pallas)

Plate 75, Figs. 149, 150

Alcyonium aurantium Pallas, 1766, p. 210.
Tethya aurantia Topsent, 1900, p. 294.

Diagnosis.—Most specimens of this sponge found in the Gulf were pinkish in alcohol, although they are usually reported as drab.

The shape of the sponge is more or less hemispherical and warty. It has a cortex 1 mm thick and a radial structure.

The spicules found in this Gulf specimen were: strongyles 10 μ by 650 μ to 38 μ by 2,500 μ; tylostrongyes 35 μ by 1,500 μ; spherasters diameter up to 100 μ; tylasters diameter up to 25 μ; microasters up to 10 μ.

Holotype.—Unknown.

Type locality.—European.

Distribution.—World wide.

Material examined.—

Sta.	537-36	Angeles Bay	3- 2-36	Shore
Sta.	540-36	Puerto Refugio	3- 3-36	Shore
Sta.	720-37	Rocky Point	3-24-37	Shore
Sta.	1049-40	Puerto Refugio	1-27-40	Shore

Remarks.—This sponge has been recorded from Baja California and from Upper California.

Order **CHORISTIDA** Sollas
Family **Ancorinidae** Gray
Genus **PENARES** Gray
Penares cortius de Laubenfels

Plate 76, Figs. 151, 152; Plate 77, Fig. 153

Penares cortius de Laubenfels, 1930, p. 26.

Diagnosis.—The architecture of this sponge is typical of the family and genus. "Principal spicules, oxeas; size, ranging up to 22 μ by 950 μ. Ectosomal spicules, dichotriaenes; size of rhabds, about 50 μ by 400 μ; size of clads, including the deuteroclads, up to 50 μ by 310 μ. First micros-

cleres, bicurvate microstrongyles; size 3 μ by 50 μ to 8 μ by 160 μ; a very few of the smallest ones are faintly centrotylote. Second microscleres; oxyspherasters, total diameter 19 μ to 25 μ, the smallest ones having the most numerous rays." (de Laubenfels 1932, p. 37.)

Holotype.—U.S.N.M.

Type locality.—Pescadero Point, California.

Distribution.—Central California to the Gulf of California.

Material examined.—

Sta. 496-36 Fraile Bay 2-18-36 160 m

Remarks.—The bicurvates found in this sponge are relatively rare. *P. tyloaster* Dendy has bicurvates, but they are oxeas instead of strongyles.

Genus STELLETTA O. Schmidt

Stelletta estrella de Laubenfels

Plate 77, Fig. 154; Plate 78, Figs. 155, 156

Stelletta estrella de Laubenfels, 1930, p. 25.

Diagnosis.—The sponge is typical of the family and subfamily. It is massive, subspherical, cartilaginous, radial in plan, and has a tough cortex.

Spicules are: oxeas, 50 μ by 2,500 μ and larger; diaenes and triaenes, up to at least 75 μ by 4,000 μ; oxyspherasters, 8 μ to 10 μ in diameter average; tylospherasters, 10 μ in diameter.

Holotype.—U.S.N.M.

Type locality.—Southern California.

Distribution.—Southern California to the Gulf of California.

Material examined.—

Sta. 707-37 Angel de la Guardia Island 3-20-37 Shore

Remarks.—There is no significant difference between the specimens of this sponge from the Gulf and those from the coast of southern California. A closely related species, *S. clarella* de Laubenfels, is found in central California.

Family Geodiidae Gray

Genus ERYLUS Gray

Erylus discastera, new species

Plate 79, Figs. 157, 158; Plate 80, Fig. 159

Diagnosis.—The size of this sponge is 4 cm by 4 cm by 7 cm, the consistency cartilaginous, the color drab throughout.

The surface is superficially smooth and has no special oxeas. No pores or oscules are visible.

There is a distinct surface layer 900 μ thick or less. This is semidetachable and apparently not over subdermal cavities. The endosome is

very fine grained and does not present any well-defined structure. The gross cavities are rare and too small to be easily seen with the naked eye.

The first megascleres are plagiotriaenes or diaenes about 40 μ by 2,000 μ. Occasional triaenes, which are almost calthrops, are also found as are small oxeas about 20 μ by 600 μ. These latter are usually dermal.

The principal microscleres are sterrasters, which are modified into the disc shape that differentiates this genus so markedly from *Geodia*. These spicules are large, averaging 240 μ in diameter. Second microsclere is a very abundant sterraster only 9 μ in diameter. A third type is a spheraster which is typically 15 μ in diameter. There are also present microstrongyles 3 μ by 60 μ.

Holotype.—AHF no. 23.

Type locality.—West of Isla Partida; 140 m; rock bottom.

Distribution.—Same.

Material examined.—

Sta.	560-36	Isla Partida	3- 9-36	140 m

Remarks.—This species is unique chiefly because of the enormous size of the sterrasters. No other species has sterrasters which compare with them.

The species *E. alleni* de Laubenfels is similar but has much smaller sterrasters and lacks the long plagiotriaenes. It is West Indian. *E. proximus* Dendy from the Indian Ocean is similar but has strongyles in addition to oxeas and it also lacks the large sterrasters.

Genus **GEODIA** Lamarck

Geodia mesotriaena Lendenfeld

Plate 80, Fig. 160; Plate 81, Figs. 161, 162; Plate 82, Figs. 163, 164

Cydonium mulleri Lambe, 1892, p. 72.

Geodia mesotriaena Lendenfeld, 1910, p. 96.

Diagnosis.—Sponges in this species have the characteristic armor of the family. When young the sponge is subspherical, but as it grows it spreads laterally into a massive cake. There is always a spicule plush present, sometimes two or more cm long, although this is frequently rubbed off or damaged. Where the plush is not too dense, special pore areas are found. The general endosomal structure tends to the radiate.

The following analysis gives the types of spicules found in *G. mesotriaena* and an indication of sizes to be expected:

Diacts (usually oxeas), often several mm long; plagiotriaenes and diaenes, often several mm long; ana- and protriaenes, several mm long (known as long as about 22 mm); dermal oxeas or styles, about 200 μ; sterrasters, 50 μ to 100 μ plus.

A variety of small asters is also found, which have well-developed spines that may be either sharp or rounded on the points. The centrum of these asters varies from conspicuous to absent. The size range is from about 2 μ to 40 μ.

Holotype.—U.S.N.M.

Type locality.—Off southern California.

Distribution.—Southern Alaska to the Gulf of California.

Material examined.—

Sta.	500-36	Espiritu Santo Island	2-20-36	Shore
Sta.	510-36	Ballenas Bay	2-22-36	Shore
Sta.	518-36	San Francisco Island	2-25-36	Shore
Sta.	614-37	Agua Verde Bay	3- 1-37	100 m
Sta.	618-37	San Jaime Bank	3- 3-37	150 m
Sta.	627-37	Ensenada de los Muertos	3- 5-37	Shore
Sta.	634-37	Espiritu Santo Island	3- 6-37	Shore
Sta.	670-37	Escondido Bay	3-12-37	70 m
Sta.	749-37	Isabel Island	4- 3-37	Shore
Sta.	1051-40	Angel de la Guardia Island	1-27-40	Shore

Remarks.—The spicules of *Geodia mesotriaena* are very large, and, therefore, differences which would go unnoticed in smaller spicules are magnified and seem more important than they are. It seems axiomatic that distinctions made on the basis of spiculation should involve gross differences only in species with such large spicules. This rule has not always been followed.

Geodia japonica (Sollas)

Plate 83, Figs. 165, 166; Plate 84, Figs. 167, 168

Cydonium japonica Sollas, 1888, p. 333.

Geodia japonica Lendenfeld, 1903, p. 52.

Diagnosis.—This sponge is massive and knobby. The surface is hispid and has special pore areas with pores about .5 mm in diameter. The entire specimen is 8 cm by 6 cm by 5 cm.

The ectosome is vary hard and about 1 mm thick. The endosome is "bready." In addition to the usual oxeas, ana- and protriaenes, there are sterrasters up to 130 μ in diameter, euasters 22 μ to 30 μ, and small siliceous masses 5 μ in diameter which may be spherasters with almost no spines.

Holotype.—U.S.N.M.

Type locality.—Japan.

Distribution.—Pacific Basin.

Material examined.—

Sta.	562-36	San Esteban Island	3-10-36	90 m

Remarks.—This sponge is not very different from *G. mesotriaena,* described above; and, although it answers the description of *G. japonica* much more closely, it may be only an atypical specimen of *G. mesotriaena.*

Genus GEODINELLA (Gray)
Geodinella isabella, new species
Plate 85, Fig. 169

Diagnosis.—This sponge is encrusting and massive. Its size is 3 cm by 6 cm by 6 cm. The consistency is leathery, and the color of the preserved specimen in dark drab. The surface is definitely hispid, although microscopically so. There is a distinct cortex 1 mm thick, which is not detachable.

The cortex is largely a sterraster armor. The sterrasters are 30 μ in diameter. Two sizes of oxeas are present. The first of these is most often about 15 μ by 550 μ. The second has an average size of 3 μ by 100 μ. These two types do not represent the ends of a continuous series, as spicules of intermediate size are not present. The tylostyles typical of the genus are the same size as the smaller oxeas. Oxyspherasters are abundant subdermally. These are 30 μ in diameter. There are also very abundantly what appear to be oxyspherasters only 5 μ in diameter.

Holotype.—AHF no. 24.

Type locality.—Isabel Island, Sinaloa, Mexico; porites coral; 4 m.

Distribution.—Same.

Material examined.—

Sta.	125-33	Isabel Island	3-19-33	4 m

Remarks.—*Geodinella robusta* Lendenfeld, reported from various *Albatross* stations of California to southern Alaska, may be a near relative of this sponge. It does not have the two size ranges of oxeas, however, and the asters are much larger.

Family Craniellidae de Laubenfels
Genus CRANIELLA Schmidt
Craniella arb (de Laubenfels)
Plate 85, Fig. 170; Plate 86, Figs. 171, 172; Plate 87, Fig. 173

Tetilla arb de Laubenfels, 1930, p. 26.

Craniella arb de Laubenfels, 1935, p. 12.

Diagnosis.—This is a spherical to subspherical sponge with a pronounced radiate structure, pronouncedly hispid, with a dense cortical area about 1 mm thick. Occasional oscules are found.

It has oxeas and ana- and protriaenes several mm long. One protriaene was found which measured 32.4 mm long. The most characteristic spicule is the spiny sigmalike microsclere, which has well-rounded, almost tylote ends. They are thicker in proportion to their length than true sigmas and are about 10 μ long.

Holotype.—U.S.N.M.

Type locality.—Pescadero Point, California.

Distribution.—Central California to the Gulf of California.

Material examined.—

Sta.	538-36	Angeles Bay	3- 3-36	50 m
Sta.	541-36	Puerto Refugio	3- 4-36	120 m
Sta.	542-36	Puerto Refugio	3- 4-36	30 m
Sta.	544-36	Puerto Refugio	3- 4-36	130 m
Sta.	618-37	San Jaime Bank	3- 3-37	150 m
Sta.	632-37	San Gabriel Bay	3- 6-37	48 m
Sta.	669-37	Danzante	3-12-37	110 m
Sta.	675-37	Pulpito Point	3-15-37	110 m
Sta.	701-37	Angeles Bay	3-20-37	40 m
Sta.	712-37	Puerto Refugio	3-21-37	30 m
Sta.	716-37	Willard Point	3-23-37	12 m
Sta.	1048-40	Puerto Refugio	1-26-40	11 m
Sta.	1057-40	Puerto Refugio	1-29-40	50 m

Remarks.—This is the most common sponge in the Hancock collection from the Gulf of California.

Order CARNOSA Carter
Family **Halinidae** de Laubenfels
Genus **PACHASTRELLA** Schmidt
Pachastrella dilifera de Laubenfels

Plate 87, Fig. 174; Plate 88, Fig. 175

Pachastrella dilifera de Laubenfels, 1934, p. 1.

Diagnosis.—This species has no clearly definied cortex, is pale drab in alcohol, and has oscules about 1 mm in diameter. The surface is relatively smooth.

In the specimen in this collection the spicules are: calthrops, each ray 70 μ by 500 μ; oxeas, 50 μ by 2,000 μ plus; spirasters, 15 μ long; metasters, 40 μ; microrhabds, 3 μ by 200 μ.

Holotype.—U.S.N.M.

Type locality.—West Indies.

Distribution.—West Indies and Gulf of California.

Material examined.—

Sta.	534-36	San Francisquito Bay	3- 2-36	250 m

Remarks.—As compared to the West Indian holotype, the spicules of these specimens tend to be slightly smaller.

The nearest relative of this sponge, *P. monilifera,* is cosmopolitan, and further collecting may prove that this specimen is widespread.

Pachastrella multipora, new species

Plate 88, Fig. 176; Plate 89, Figs. 177, 178; Plate 90, Figs. 179, 180; Plate 91, Fig. 181

Diagnosis.—This specimen is 7 cm by 4 cm by 1½ cm. Both ectosomal and endosomal portions are drab in alcohol. The consistency is woody, and there is a distinct hispidation. A detachable surface membrane 200 μ thick is found. Pores are very abundant and range from 30 μ to 90 μ in diameter. No oscules are evident.

The endosome is "bready" with some suggestion of vertical to radial structure. Gross endosomal cavities are larger just beneath the ectosomal membrane. Flagellate chambers 25 μ in diameter are occasionally seen.

The principal megascleres are calthrops with rays 45 μ by 390 μ and oxeas 32 μ by 800 μ. The microscleres are metasters 12 μ long, peculiar spirasters, with short, blunt rays, also 12 μ long.

Holotype.—AHF no. 25.

Type locality.—Off White Rock, Isla Partida; 60 m; bottom of sand and gravel.

Distribution.—Gulf of California.

Material examined.—

Sta.	556-36	Isla Partida	3- 8-36	60 m
Sta.	559-36	Isla Partida	3- 9-36	90 m

Remarks.—This sponge, also found in the Gulf of California, differs from *Pachastrella dilifera* in the much smaller size of the microscleres, the presence of a definite detachable ectosomal membrane, the absence of the large metasters, and the difference in structure of the spirasters. *P. monilifera* Schmidt has centrotylote microrhabds 10 μ to 20 μ long instead of the long raphids. *P. cribium* Lebwohl from Japan has the large metasters and very thick microrhabds.

Genus **SPHINCTERELLA** (Schmidt)

Sphincterella osculanigera, new species

Plate 91, Fig. 182; Plate 92, Figs. 183, 184; Plate 93, Fig. 185

Diagnosis.—The specimen of this sponge is 3 cm by 2 cm by 2 cm and is cartilaginous in consistency. In alcohol the sponge has an olive-green

ectosome and a drab endosome. The surface is superficially smooth. There are oscules 2,500 μ in diameter. These are coronal and covered by a black sieve net with openings 100 μ in diameter.

There is a well-marked ectosome 1 mm thick, which may be detached with difficulty.

The gross endosomal structure is "bready" and confused.

The principal spicules are oxeas 75 μ by 2,100 μ and calthrops 95 μ by 410 μ. A few of the latter are only triradiates. Two smaller types of oxeas are present. The first, 2 μ by 800 μ, is smooth. The second, 10 μ by 375 μ, is lumpy and gives the impression of having a series of small rings around it throughout its length. There are also characteristic asters, which average about 15 μ in length.

Holotype.—AHF no. 26.

Type locality.—Tepoca Bay, Mexico; from the shore of a rocky reef.

Distribution.—Same.

Material examined.—

Sta. 1077-40 Tepoca Bay 2- 4-40 13 m

Remarks.—*Sphincterella tricornis* Wilson, 1904, from Panama seems to be the nearest relative of this sponge. It, however, has very much larger oxeas, 135 μ by 5,000 μ, only the smaller size of triradiates, and lacks the black net arrangement which is so striking a feature of the Hancock sponge.

Family **Plakinastrellidae** de Laubenfels

Genus **POECILLASTRA** Sollas

Poecillastra tenuilaminaris Sollas

Plate 93, Fig. 186; Plate 94, Fig. 187

Normia tenuilaminaris Sollas, 1880, p. 186.
Poecillastra tenuilaminaris Sollas, 1888, p. 85.

Diagnosis.—This is a thin sponge, stiff, drab in alcohol, and smooth. Typical spicule measurements are as follows:

Calthrops (size of rays), 50 μ by 450 μ; oxeas, 3,870 μ by 60 μ; plesiasters (greater length), 30 μ; metasters (greater length), 15 μ; micoxeas, 3 μ by 145 μ.

Holotype.—British Museum.

Type locality.—Japan.

Distribution.—This sponge has been found in southern California near Santa Catalina Island as well as in Japan and the Gulf of California.

Material examined.—This sponge was found in the Gulf of California. Exact location is unknown.

Remarks.—Spicules in this specimen are somewhat larger than is typical.

Order ASCONOSA de Laubenfels
Family Leucettidae de Laubenfels
Genus LEUCETTA Haeckel
Leucetta losangelensis de Laubenfels

Plate 94, Fig. 188; Plate 95, Figs. 189, 190; Plate 96, Fig. 191

Leuconia losangelensis de Laubenfels, 1930, p. 25.
Leucetta losangelensis de Laubenfels, 1932, p. 13.

Diagnosis.—The majority of the specimens of this sponge are amorphous, approaching closely, as in the holotype, the form of the Demospongia.

The principal spiculation is a confused mass of triaxons, both regular and sagittal, with rays varying from 10 μ to 45 μ to 40 μ by 450 μ. Oxeas are occasionally present but are almost certainly not proper. Quadriradiates almost never occur.

Holotype.—U.S.N.M.

Type locality.—Laguna Beach, California.

Distribution.—Southern California to the Gulf of California.

Material examined.—

Sta.	497-36	Fraile Bay	2-18-36	15 m
Sta.	515-36	San Francisco Island	2-24-36	Shore
Sta.	518-36	San Francisco Island	2-25-36	Shore
Sta.	652-37	San Francisco Island	3- 9-37	Shore
Sta.	659-37	Agua Verde Bay	3-10-37	Shore
Sta.	713-37	Puerto Refugio	3-21-37	50 m
Sta.	1045-40	Tiburon Island	1-25-40	Shore
Sta.	1077-40	Tepoca Bay	2- 4-40	13 m
Sta.	1084-40	San Pedro Nolasco	2- 6-40	111 m

Remarks.—This is the most common calcareous sponge of the Gulf. Calcareous sponges do not appear as abundantly in the Hancock collection as one would expect.

The specimens of this species in this collection do not differ materially from those off southern California, although a few Gulf specimens show a tendency toward a tubelike form.

Family Leucosoleniidae Minchin
Genus LEUCOSOLENIA Bowerbank
Leucosolenia irregularis Jenkin

Plate 96, Fig. 192; Plate 97, Fig. 193

Leucosolenia irregularis Jenkin, 1908, p. 44.

Diagnosis.—As is typical of members of this genus, this is a small white sponge rather brittle to fragile in consistency. The spicules are triacts in which one of the rays is much larger than the others, 40 μ by

600 μ in the largest spicules. The smaller rays are 12 μ by 200 μ. Oxeas are also present. A typical size is 27 μ by 700 μ. This specimen shows the typical ascon development of the genus.

Holotype.—British Museum.

Type locality.—East Africa.

Distribution.—Cosmopolitan.

Material examined.—

Sta. 584-36 Concepción Bay 3-14-36 8 m

Remarks.—The shape of this sponge is not very symmetrical; in fact, it tends to be leafy. It is quite probable that this specimen may not be conspecific with Jenkin's sponge, as the spicule sizes are even larger than he reported, but there are such an enormous number of species *Leucosolenia* that it seemed better to identify this specimen with Jenkin's species rather than erect a new species where the differences are not clear cut.

SUMMARY

1. A detailed, systematic study of the sponges of the Gulf of California is recorded here. The only sponge collecting in the region for scientific purposes, previous to the Allan Hancock Pacific Expeditions, was done on the *Albatross* Expedition in 1891. Three specimens so far as known were reported from the Gulf on that cruise, all from relatively deep water.

2. Three classes, 10 orders, 30 families, 56 genera, and 67 species of sponges are represented in the Allan Hancock Foundation collection of sponges from the Gulf of California.

3. Twenty-six species and one genus of sponges, new to science, are described in this paper.

4. The Demospongia are the dominant type found in the Gulf of California. Less than 4 per cent of the sponges collected from the region are Calcarea, as against a normal expectancy of 10 to 15 per cent for shallow water forms. This is probably due to the fresh water poured into the confined area of the Gulf of California from the Colorado River.

5. There is evidence that the Gulf of California presents near optimum conditions for sponges because species density is very great, while population density per species is low.

6. The waters of tropical and subtropical America in both the Atlantic and Pacific Oceans should be considered as a single faunal unit in spite of present-day isolation because of the number of "geminate" and "identical" species in the two areas.

7. The sponge "geminates" occurring on the two sides of tropical and subtropical America have not arisen by convergent evolution under the influence of similar conditions, because the conditions in areas where "geminates" occur are widely different.

8. The sponge fauna of the Gulf of California and the West Indies are closely related. Fifty-eight per cent of the sponges in the Allan Hancock Foundation from the Gulf are either identical with, or "geminates" of, West Indian forms.

9. The major portion of the sponge fauna of the Gulf of California arose as an "off branching" from the West Indian stock probably in the late Miocene period when the portal of Tehuantepec across Mexico was open.

10. A large portion of the present sponge fauna of the coast of California proper probably arose as an extension of the fauna of the Gulf of California. Forty-eight per cent of the sponge genera from the Gulf in the Allan Hancock collection are identical with, or "geminates" of, forms from the coast of California proper.

11. There is some evidence that the coast of California may represent, for sponges, a transition zone between the tropical, or subtropical, and temperate regions.

12. The sponge fauna of the Gulf of California is intermediate between that of the West Indies and that of the coast of California proper. "Geminate species" occurring in the latter region arise either because California forms are identical with Gulf forms, which in turn are "geminates" of sponges from the West Indies or because the Gulf sponges, which are "geminates" of California forms, are identical.

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EXPLANATION
OF
PLATES

(All photographs by H. B. Gray, Biology Department, Polytechnical High School, Long Beach, California)

PLATE 1

Fig. 1. *Halme hancocki,* new species.
Fig. 2. *Halme hancocki,* new species, close-up of the surface.

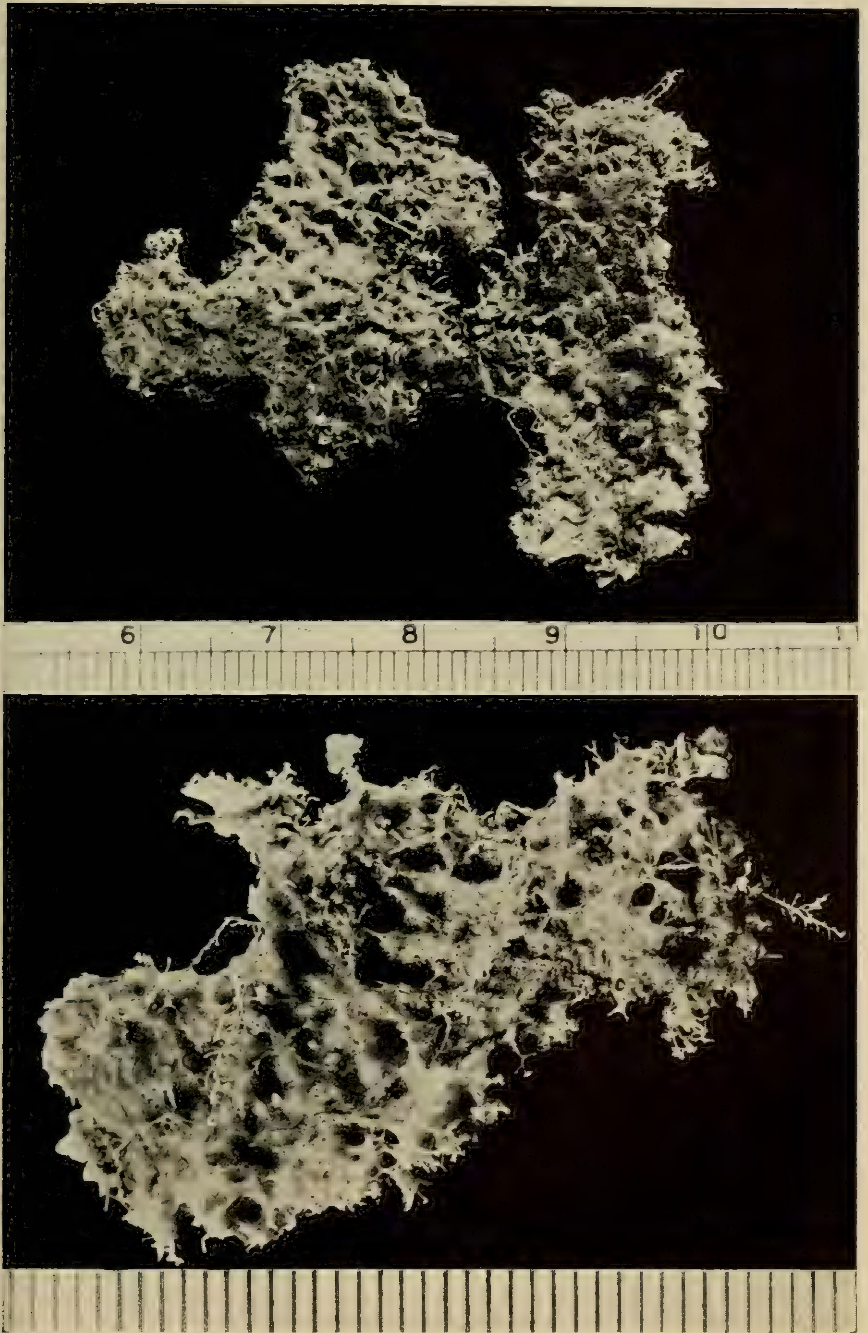
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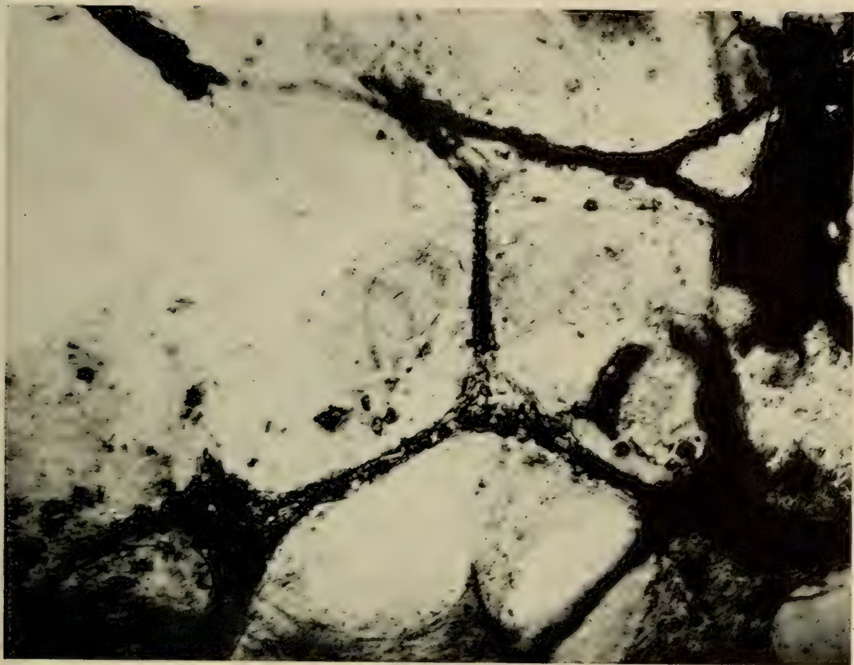
PLATE 2

Fig. 3. *Halme hancocki,* new species, primary fibers. x 50.
Fig. 4. *Halme hancocki,* new species, secondary fibers. x 50.



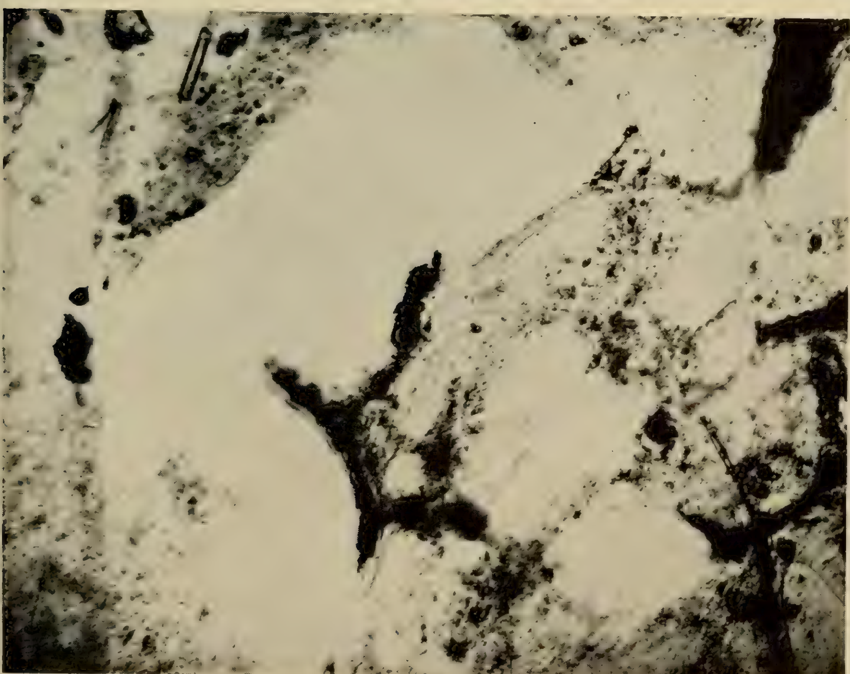


PLATE 3

Fig. 5. *Hircinia fusca* Carter.
Fig. 6. *Verongia thiona* de Laubenfels.

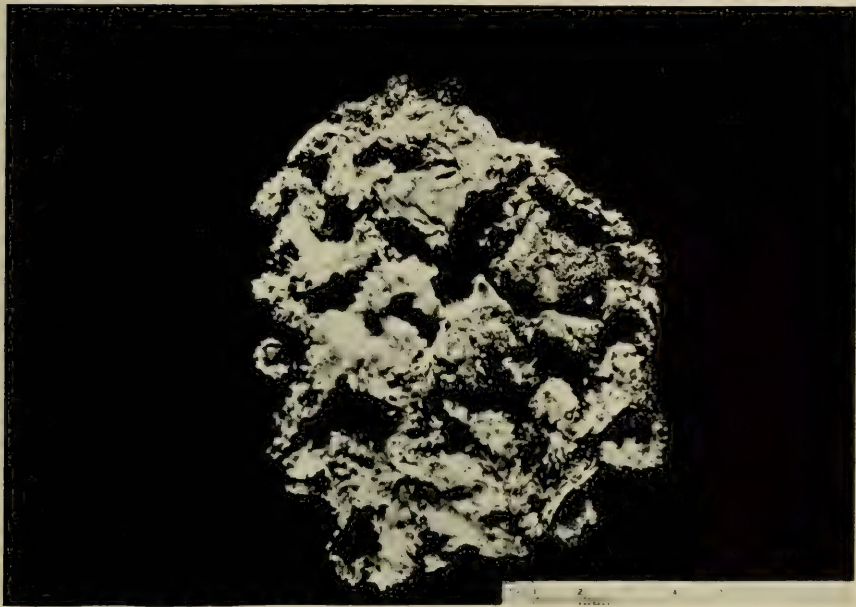
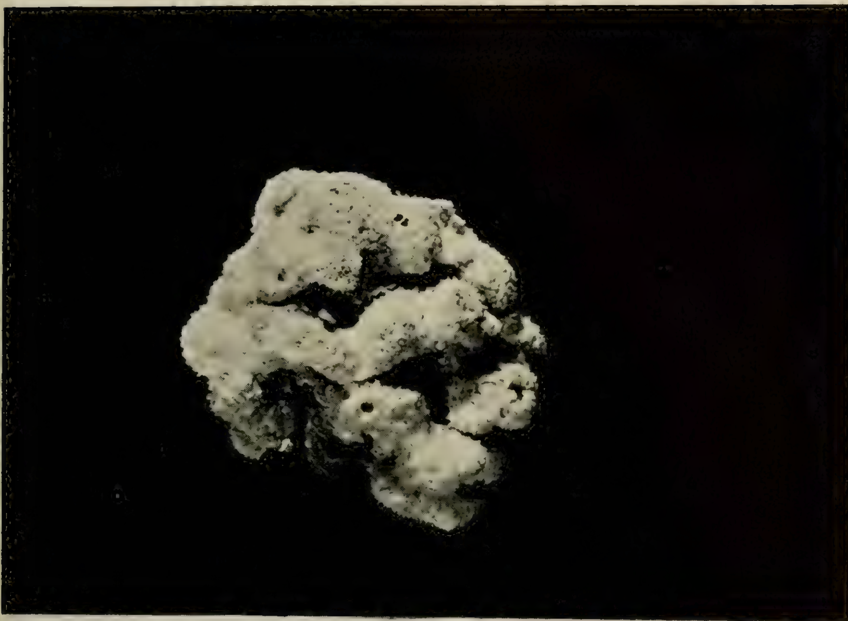


PLATE 4

Fig. 7. *Dysidea amblia* de Laubenfels.
Fig. 8. *Dysidea amblia* de Laubenfels, fibers. x 50.



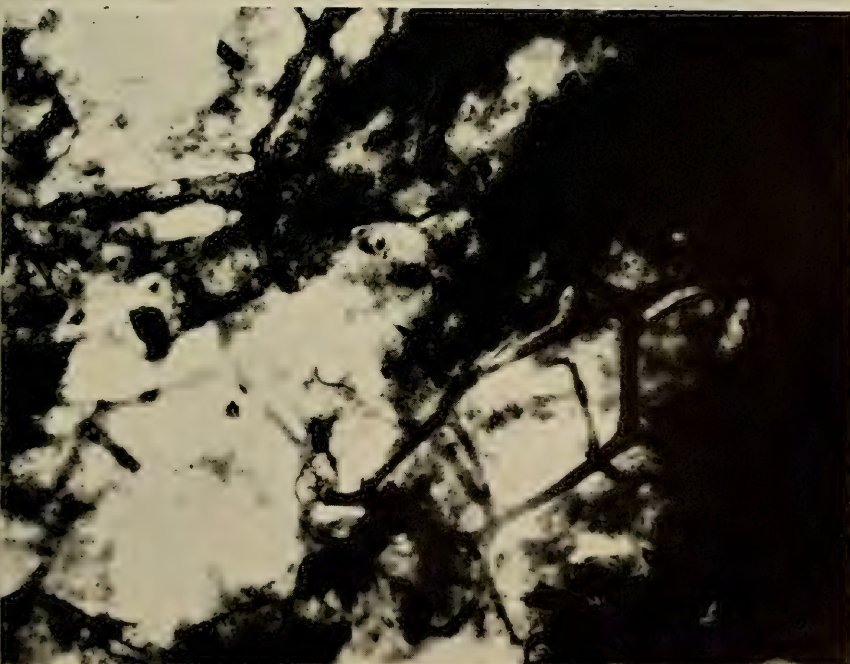


PLATE 5

Fig. 9. *Haliclona cinerea* (Grant).
Fig. 10. Close-up of the surface of *Haliclona cinerea* (Grant).

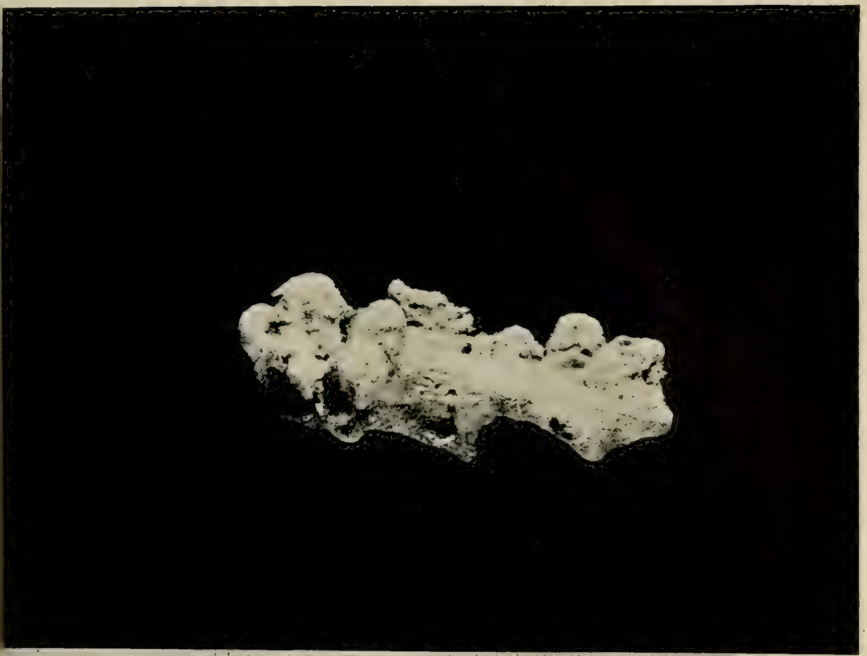


PLATE 6

Fig. 11. *Haliclona palmata* (Ellis and Solander).

Fig. 12. *Haliclona palmata* (Ellis and Solander), fibrous reticulation. x 50.

PLATE 7

Fig. 13. *Haliclona palmata* (Ellis and Solander), showing spicules within fibers.

Fig. 14. *Haliclona permolis* (Bowerbank).

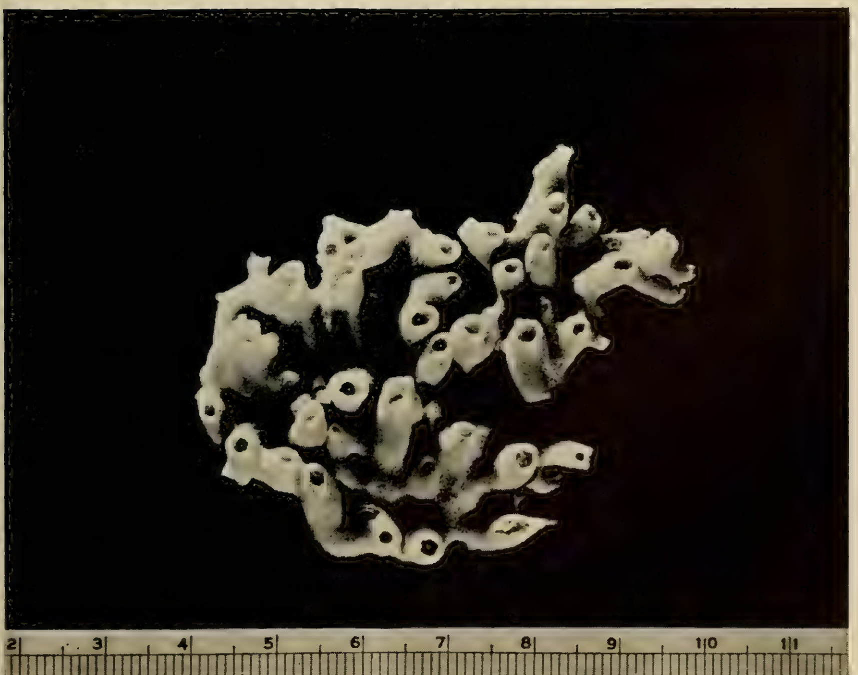

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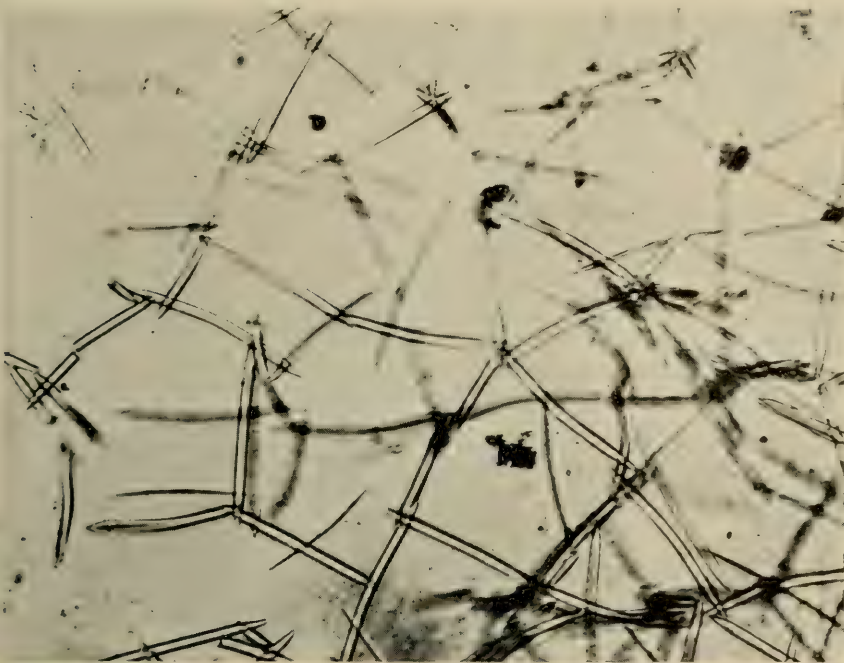
PLATE 8

Fig. 15. *Haliclona permolis* (Bowerbank), isodictyal reticulation. x 200.

Fig. 16. *Callyspongia californica,* new species.



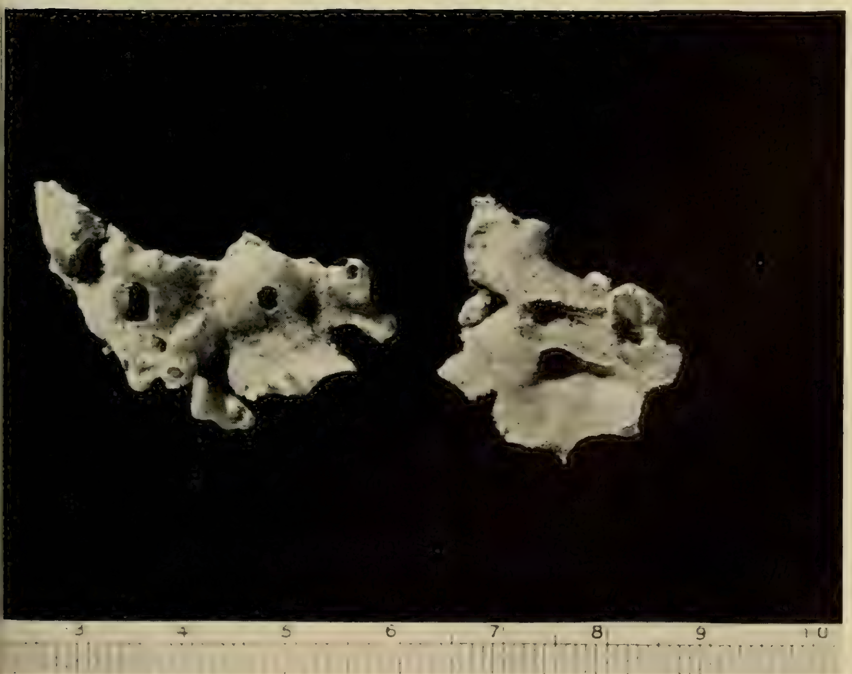

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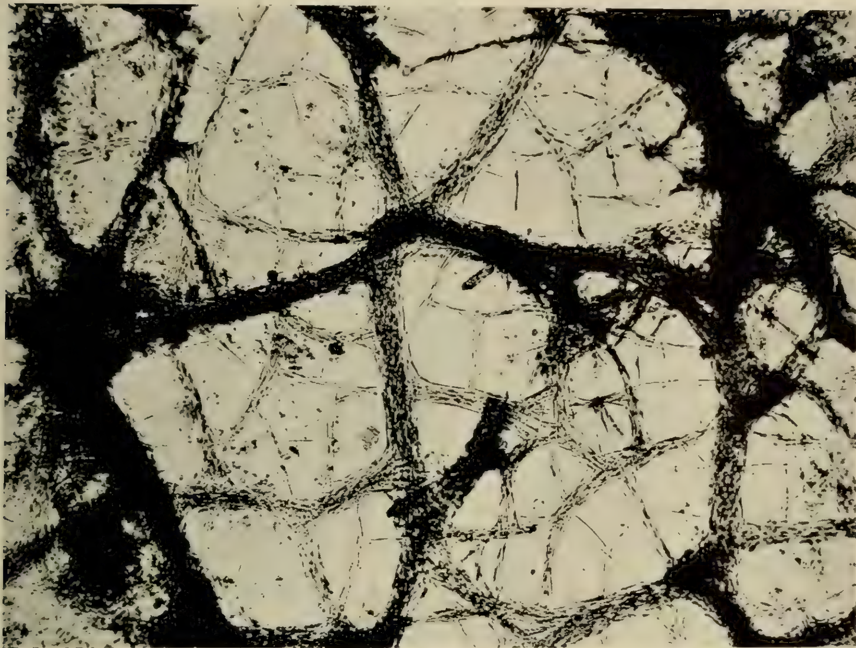
PLATE 9

Fig. 17. *Callyspongia californica,* new species, fiber mesh. x 110.
Fig. 18. *Callyspongia californica,* new species, fiber mesh. x 370.



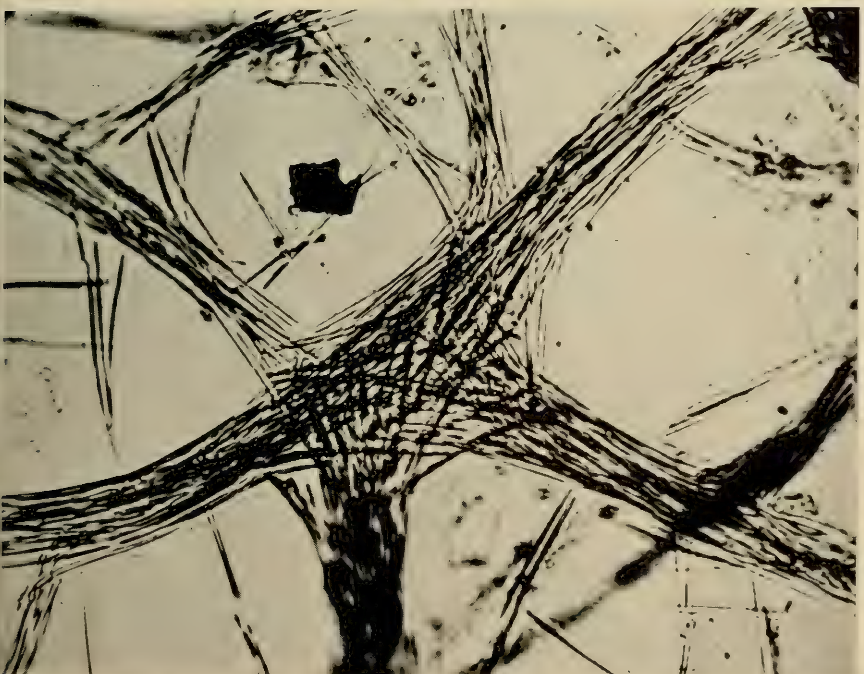


PLATE 10

Fig. 19. *Adocia gellindra* de Laubenfels.
Fig. 20. *Adocia gellindra* de Laubenfels, isodictyal reticulation.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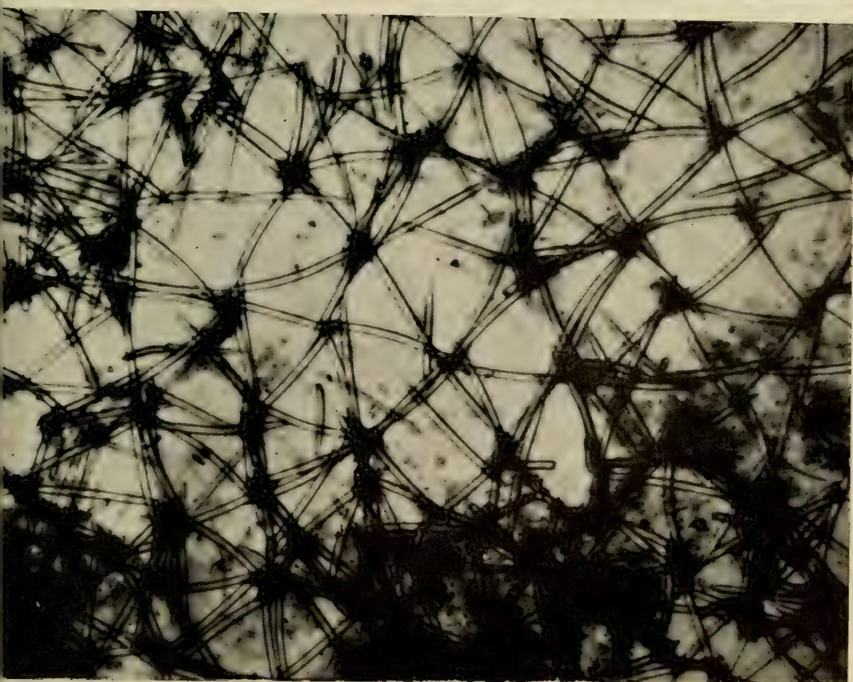

PLATE 11

Fig. 21. *Adocia ambrosia,* new species.
Fig. 22. *Adocia ambrosia,* new species.

PLATE 12

Fig. 23. *Adocia ambrosia,* new species, showing gross internal anatomy.

Fig. 24. *Adocia ambrosia,* new species, isodictyal reticulation of oxeas. x 110.

PLATE 13

Fig. 25. *Pellina semitubulose* (Lieberkühn).

Fig. 26. *Pellina semitubulose* (Lieberkühn), isodictyal reticulation of oxeas. x 110.

PLATE 14

Fig. 27. *Sigmadocia edaphus* de Laubenfels.
Fig. 28. *Sigmadocia edaphus* de Laubenfels, typical oxea. x 200.

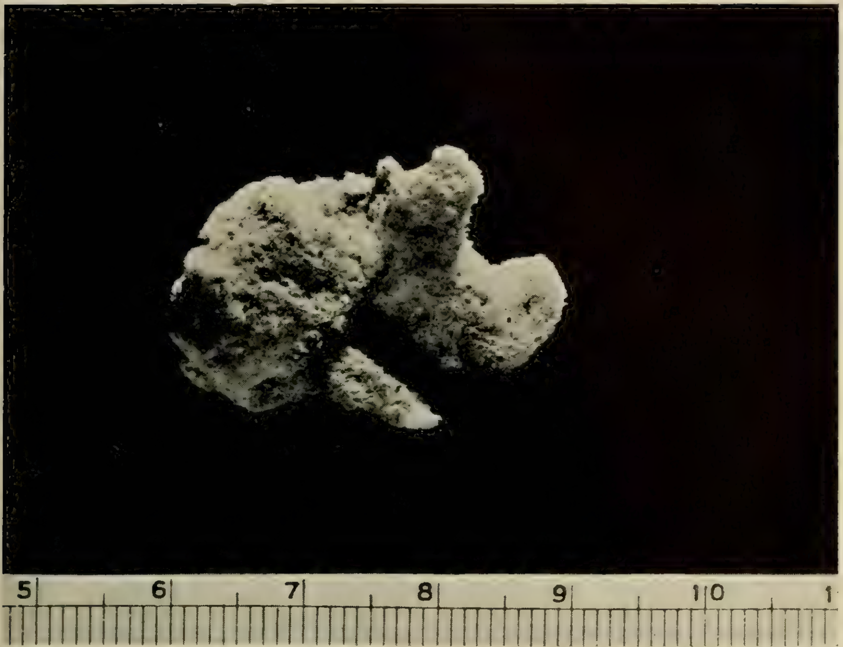
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PLATE 15

Fig. 29. *Sigmadocia edaphus* de Laubenfels, distorted sigmas. x 770.
Fig. 30. *Rhizochalina pacifica,* new species, typical specimens.

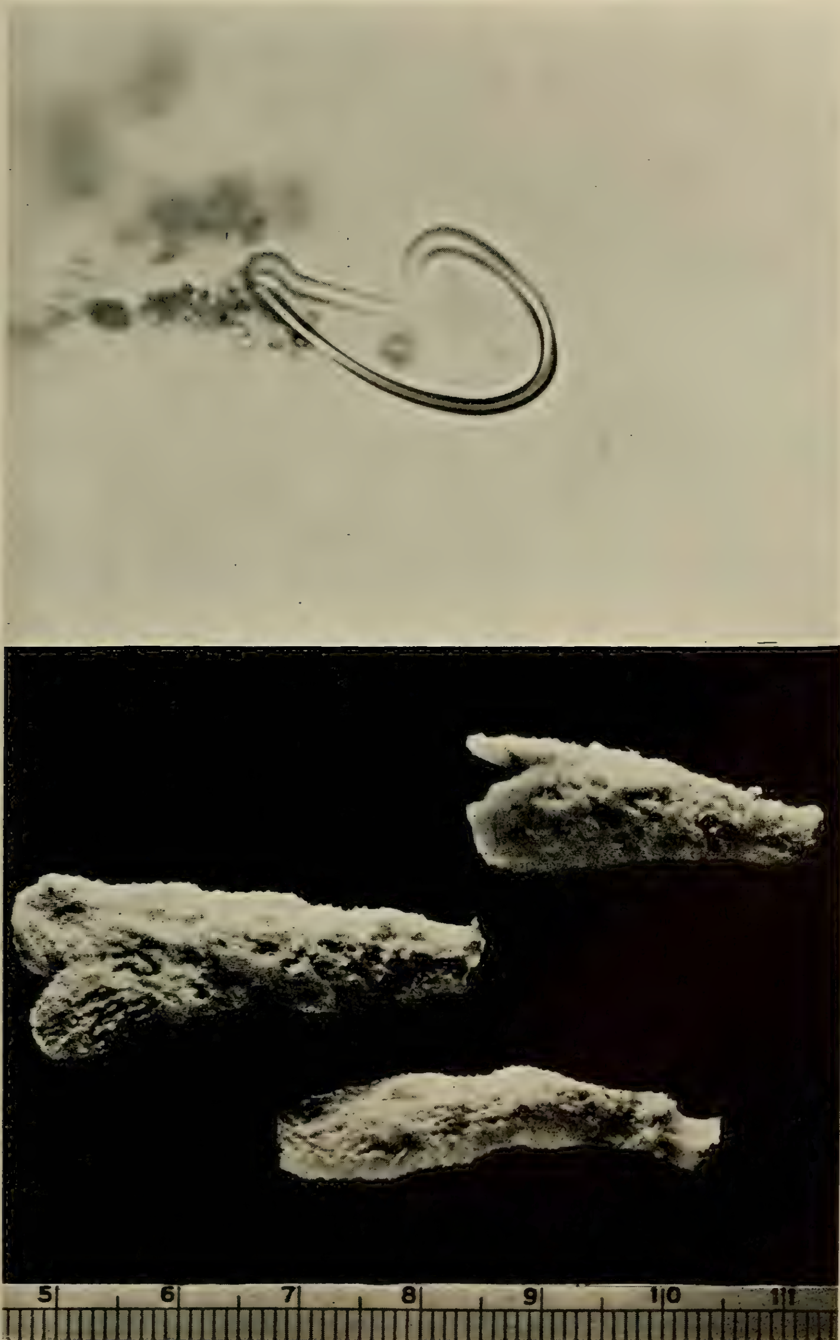
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PLATE 16

Fig. 31. *Rhizochalina pacifica,* new species, typical specimens, longitudinal section.

Fig. 32. *Rhizochalina pacifica,* new species, typical specimens, principal fibers containing the oxeas.

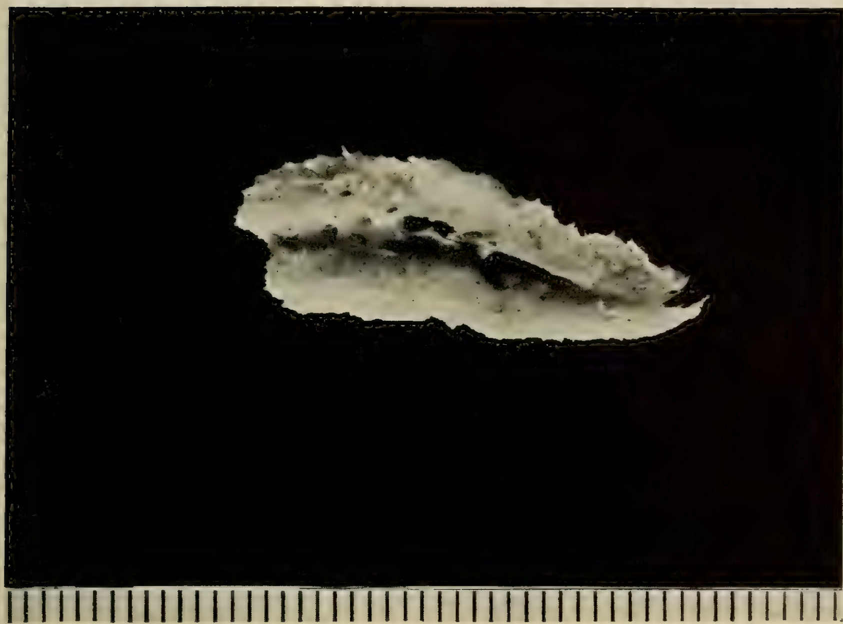

PLATE 17

Fig. 33. *Plocamia karyoka,* new species.
Fig. 34. *Plocamia karyoka,* new species, strongyles. x 370.

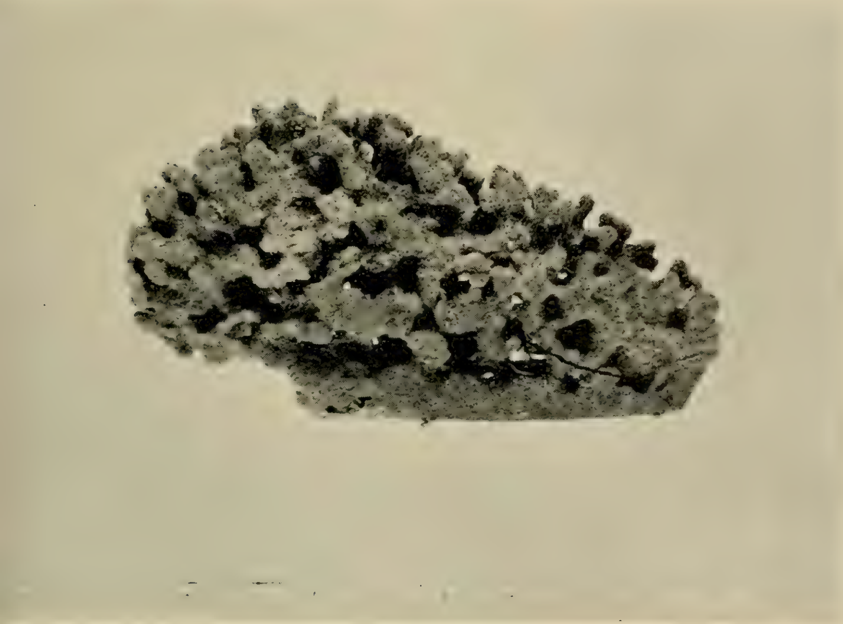

PLATE 18

Fig. 35. *Plocamia karyoka,* new species, contorted chelas. x 770.
Fig. 36. *Plocamionida igzo* de Laubenfels, tylostyles, typical. x 100.

PLATE 19

Fig. 37. *Cyamon argon,* new species.

Fig. 38. *Cyamon argon,* new species, triact with short ray spine. x 200.

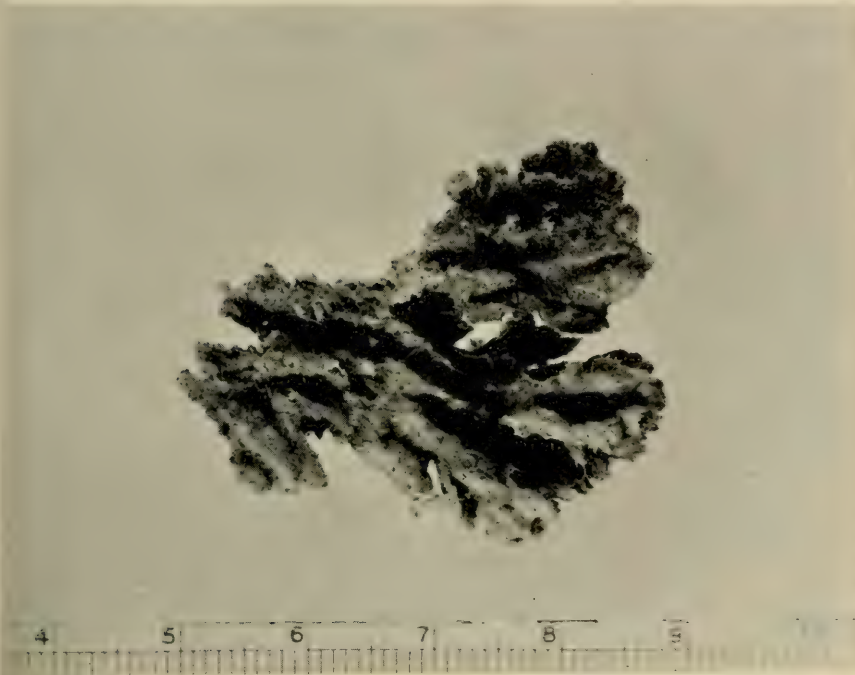
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PLATE 20

Fig. 39. *Trikentrion helium,* new species, characteristically spined triacts. x 200.

Fig. 40. *Trikentrion helium,* new species, a tuft of long, thin oxeas found in this species. x 200.

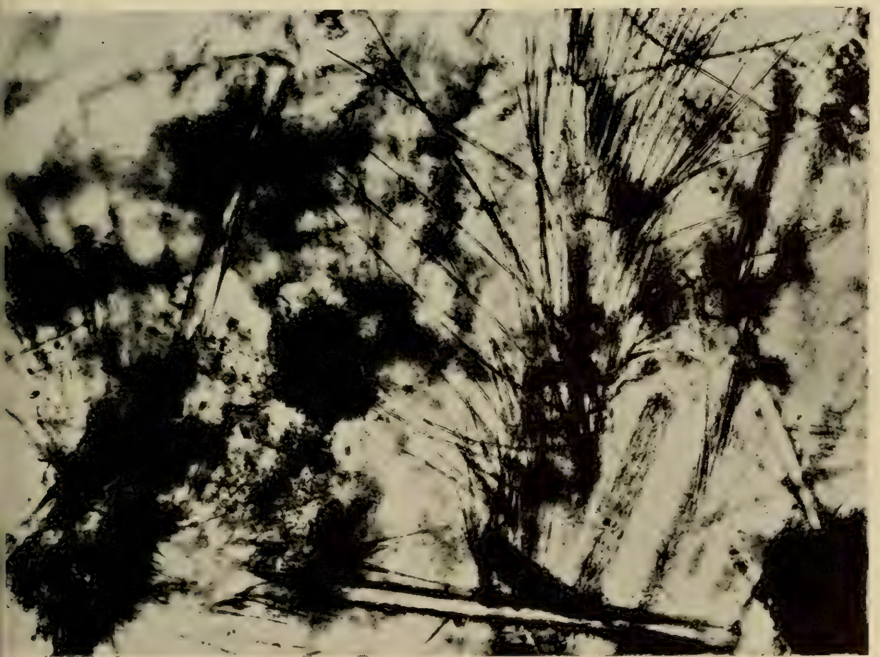

PLATE 21

Fig. 41. *Iophon indentatus* (Gray).
Fig. 42. *Iophon indentatus* (Gray), an acanthostyle. x 200.

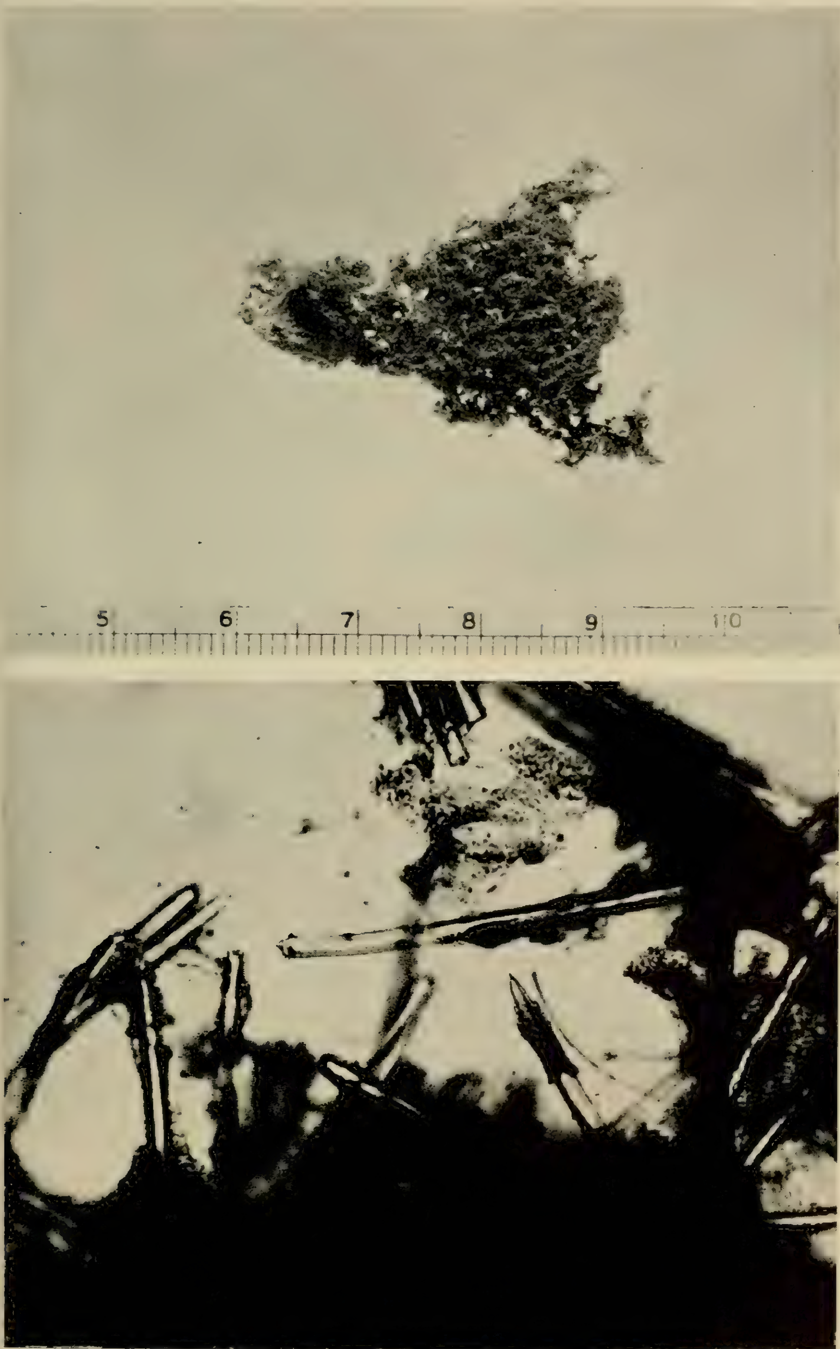
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PLATE 22

Fig. 43. *Iophon indentatus* (Gray), a bipocillate. x 770.

Fig. 44. *Myxichela microtoxa,* new species, typical acanthostyles.

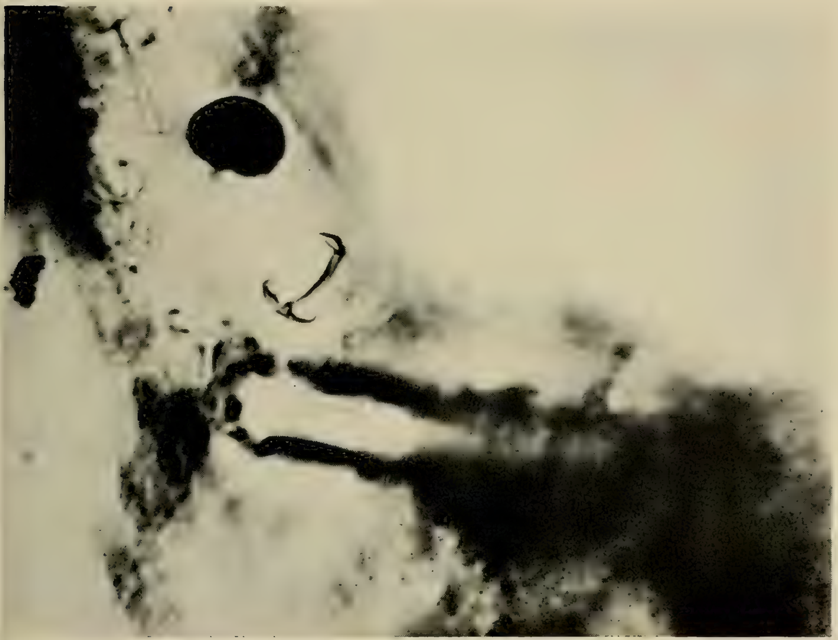

PLATE 23

Fig. 45. *Myxichela microtoxa,* new species, the small toxa which gives this species its name. x 370.

Fig. 46. *Myxichela microtoxa,* new species, a palmate isochela. x 770.

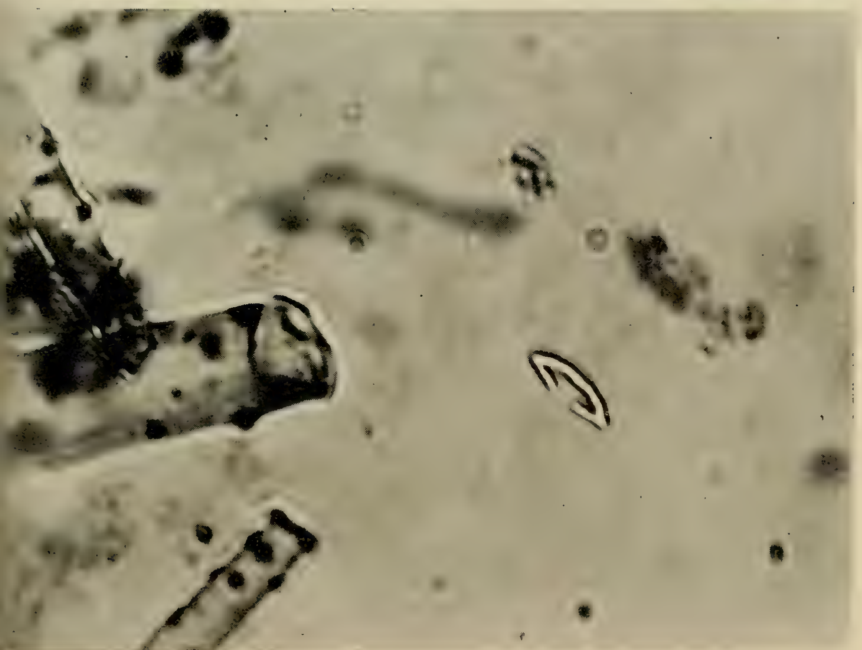

PLATE 24

Fig. 47. *Myxilla mexicensis,* new species.

Fig. 48. *Myxilla mexicensis,* new species, point and slightly spiny head of a style. x 100.

PLATE 25

Fig. 49. *Myxilla mexicensis,* new species, anchorate chelas. x 770.
Fig. 50. *Myxilla mexicensis,* new species, a sigma. x 770.

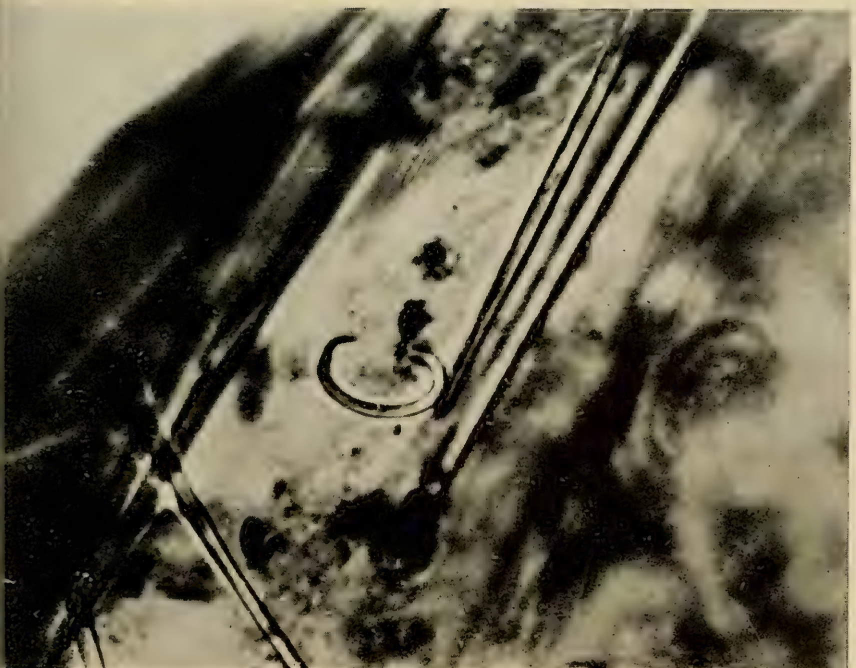

PLATE 26

Fig. 51. *Tedania nigrescens* (Schmidt).

Fig. 52. *Tedania nigrescens* (Schmidt), characteristic view of spicules showing styles, tylotes, and rhaphids. x 200.

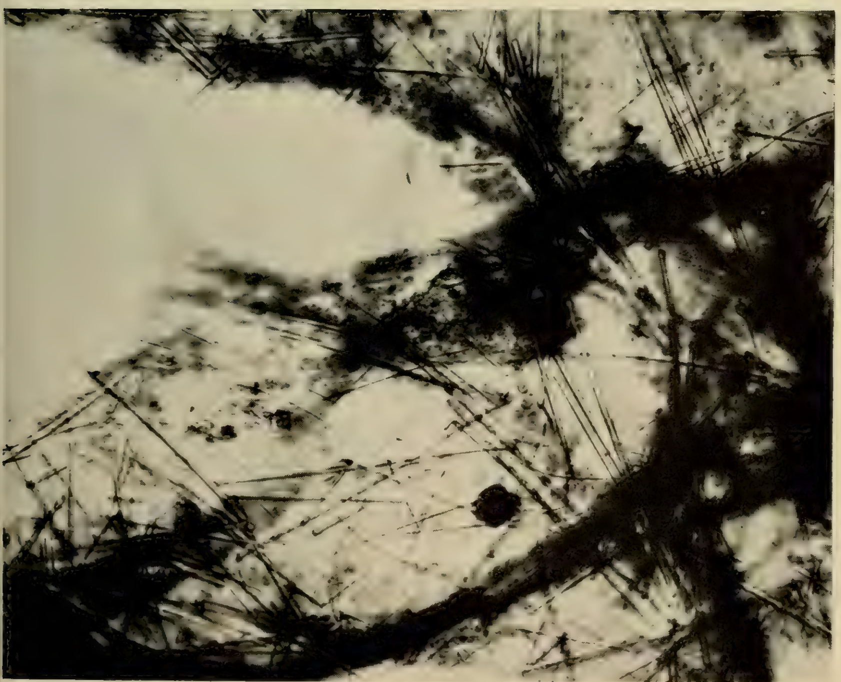

PLATE 27

Fig. 53. *Acarnus erithacus* de Laubenfels, a palmate isochela. x 770.

Fig. 54. *Acarnus erithacus* de Laubenfels, cladotylotes and styles. x 100.

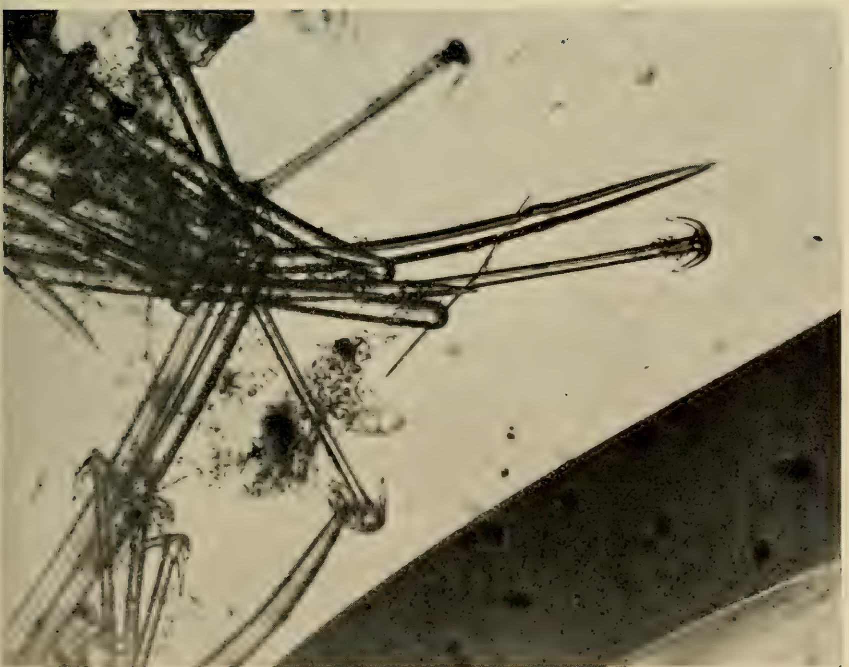

PLATE 28

Fig. 55. *Acarnus erithacus* de Laubenfels, a giant toxa with chelas at lower left. x 200.

Fig. 56. *Lissodendoryx isodictyalis* Topsent, overgrown with hydroid.

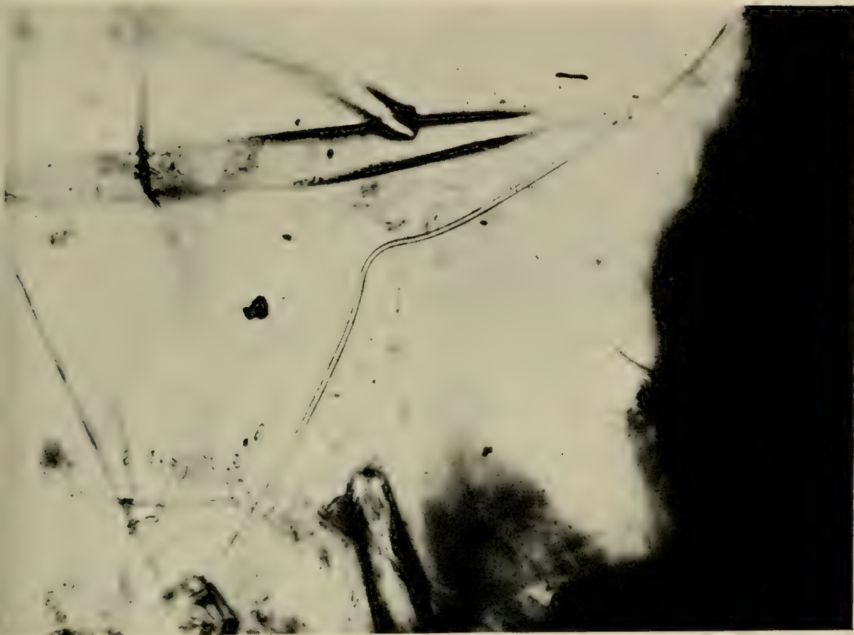


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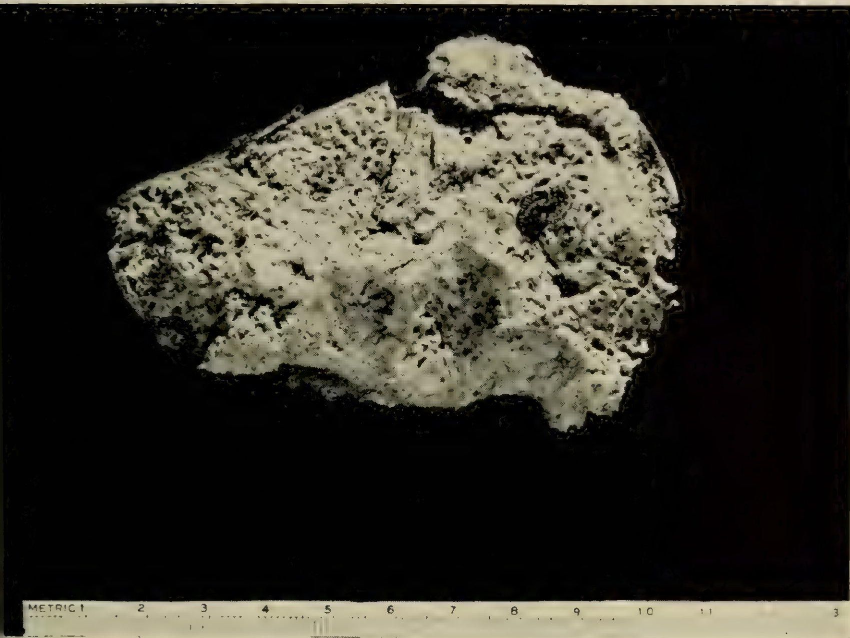
PLATE 29

Fig. 57. *Lissodendoryx isodictyalis* Topsent, with most of cortex removed.

Fig. 58. *Lissodendoryx isodictyalis* Topsent, tylotes with a sigma at lower center. x 300.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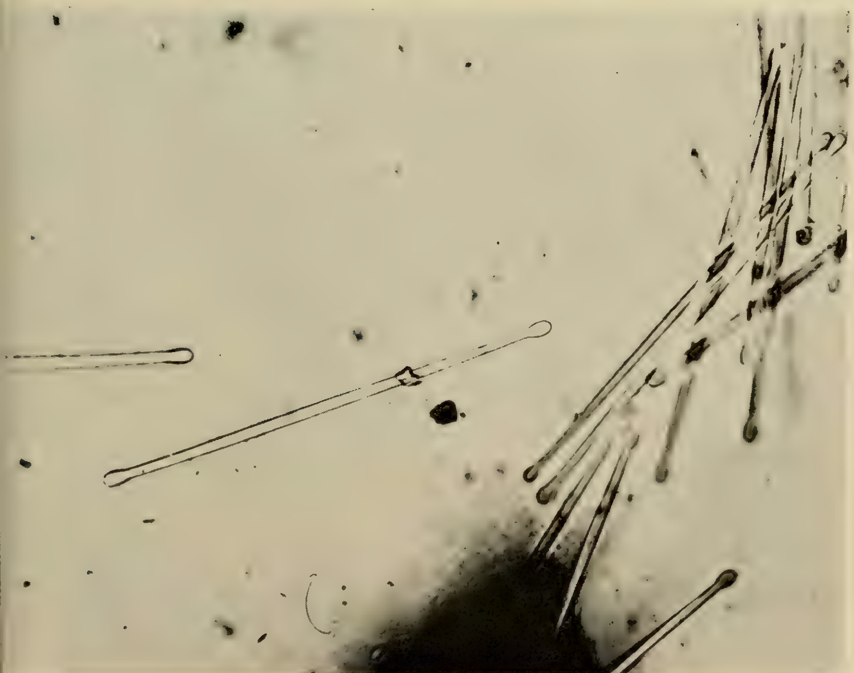

PLATE 30

Fig. 59. *Lissodendoryx isodictyalis* Topsent, sigma. x 770.
Fig. 60. *Lissodendoryx isodictyalis* Topsent, arcuate isochelas. x 770.

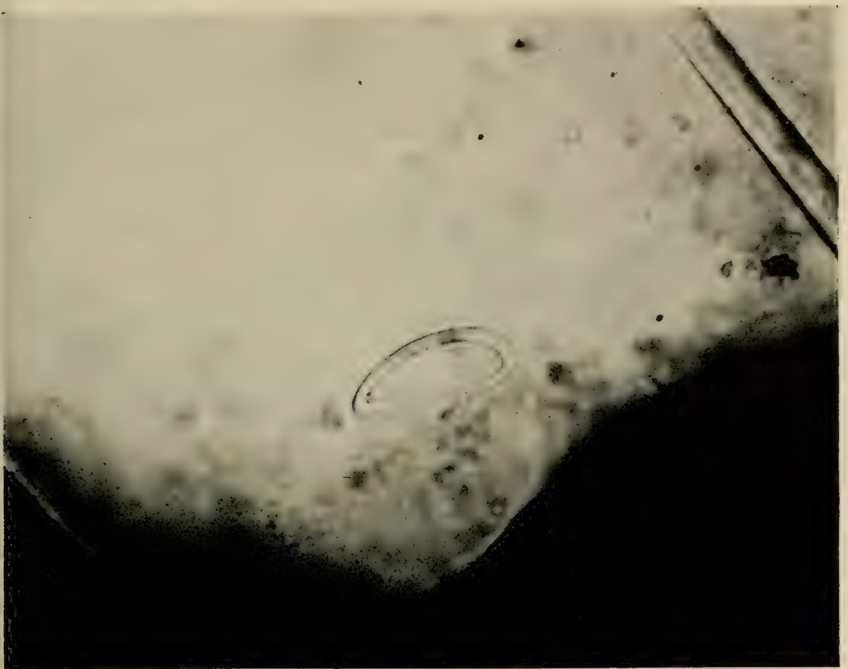

PLATE 31

Fig. 61. *Hemectyon hyle* de Laubenfels, typical acanthostyles. x 200.
Fig. 62. *Hemectyon hyle* de Laubenfels, typical acanthostyles. x 200.

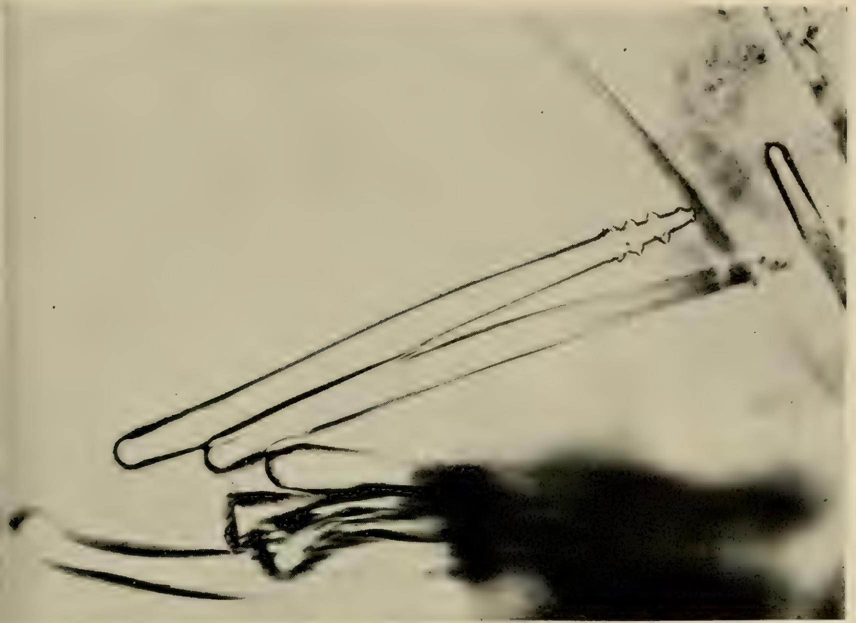

PLATE 32

Fig. 63. *Hemectyon hyle* de Laubenfels, a fragment.
Fig. 64. *Hemectyon hyle* de Laubenfels, growing on a mollusk shell.

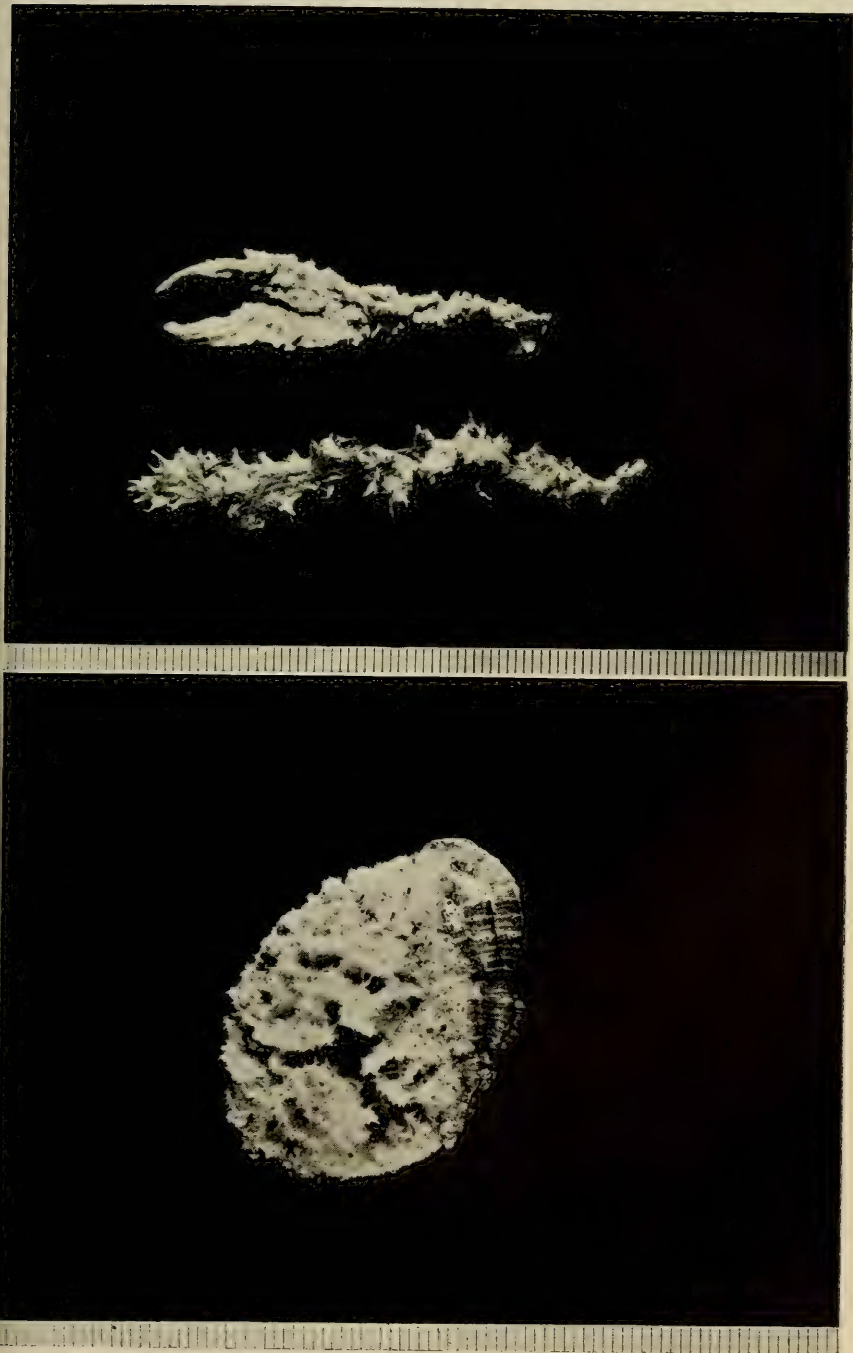

PLATE 33

Fig. 65. *Hemectyon hymani,* new species.
Fig. 66. *Hemectyon hymani,* new species, bent acanthostyles. x 200.

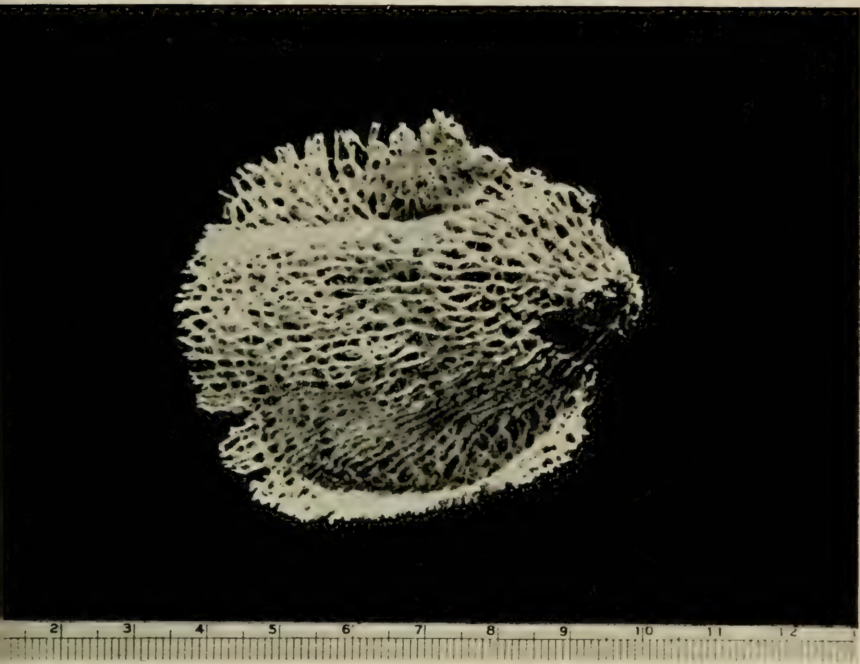
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PLATE 34

Fig. 67. *Heterectya cerebella,* new species.

Fig. 68. *Heterectya cerebella,* new species, typically bent acanthostyle. x 200.

PLATE 35

Fig. 69. *Isociona lithophenix* de Laubenfels, ectosome removed at upper right.

Fig. 70. *Isociona lithophenix* de Laubenfels, encrusting a rock.

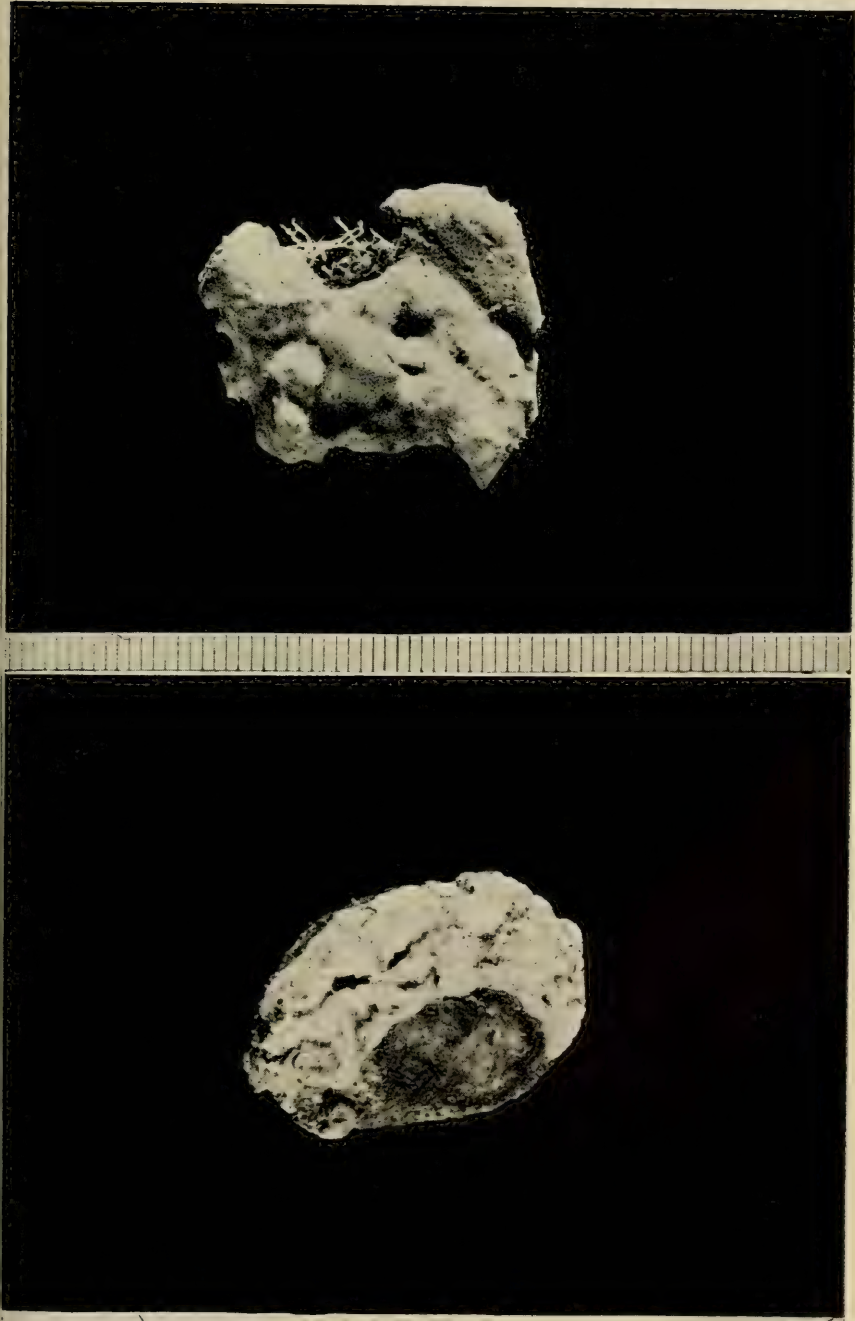
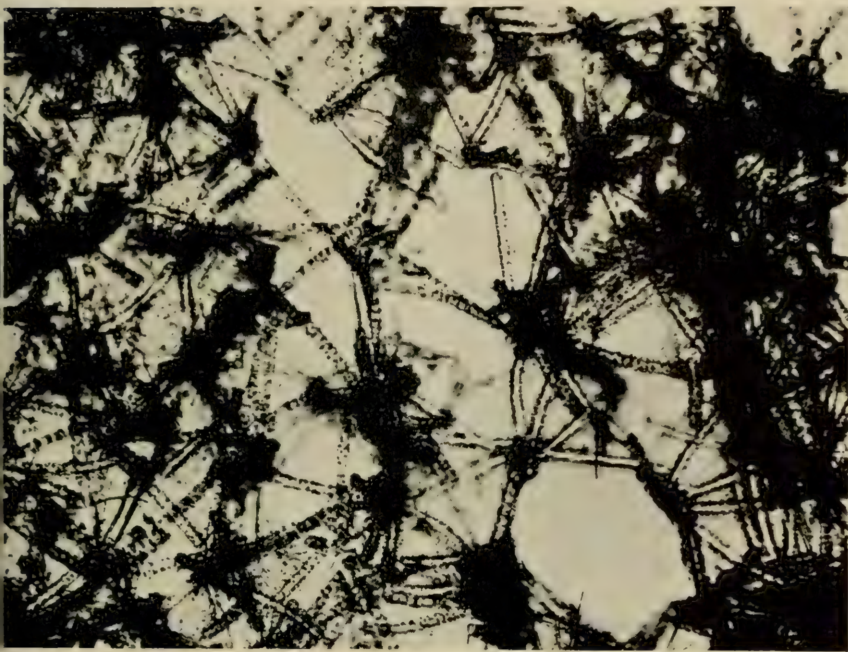


PLATE 36

Fig. 71. *Isociona lithophenix* de Laubenfels, typical reticulations of acanthose spicules.

Fig. 72. *Isociona lithophenix* de Laubenfels, palmate isochelas. x 770.



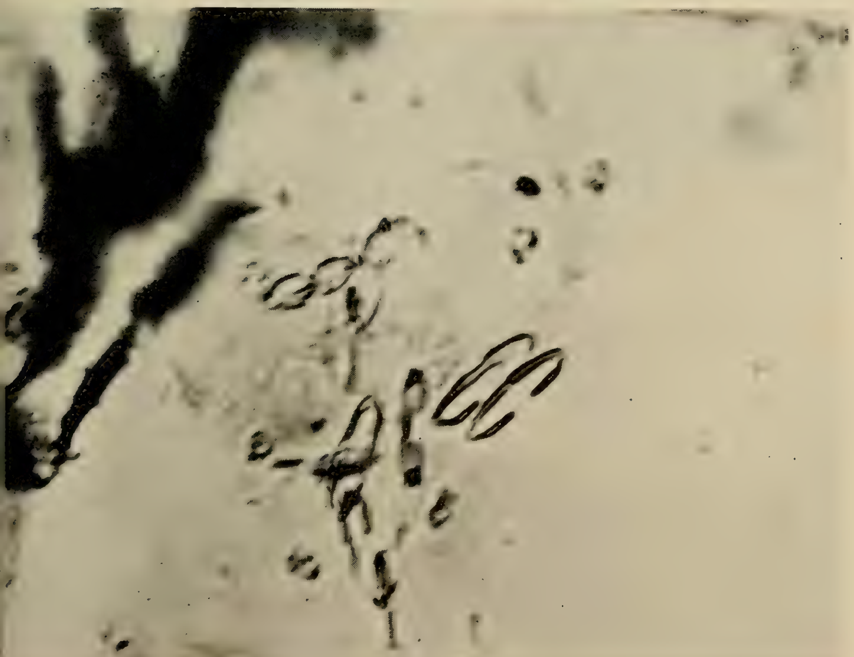


PLATE 37

Fig. 73. *Mycale angulosa* (Duchassaing and Michelotti).

Fig. 74. *Mycale angulosa* (Duchassaing and Michelotti), longitudinal section showing gross architecture.

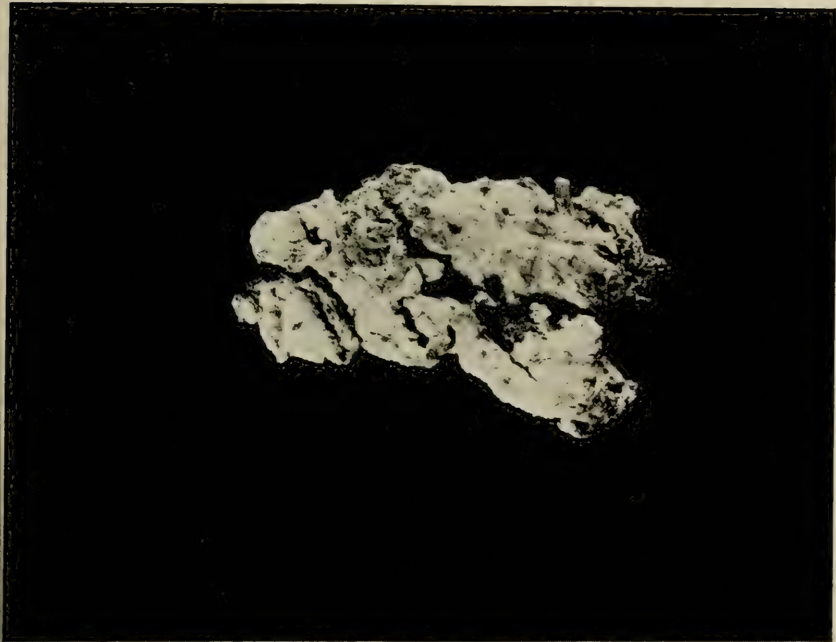


PLATE 38

Fig. 75. *Mycale angulosa* (Duchassaing and Michelotti), subtylostyles with chelas and sigmas in the background. x 200.

Fig. 76. *Mycale angulosa* (Duchassaing and Michelotti), sigma and chela enlarged. x 770.

PLATE 39

Fig. 77. *Carmia contax,* new species.

Fig. 78. *Carmia contax,* new species, styles to subtylostyles in vague tracts. x 200.

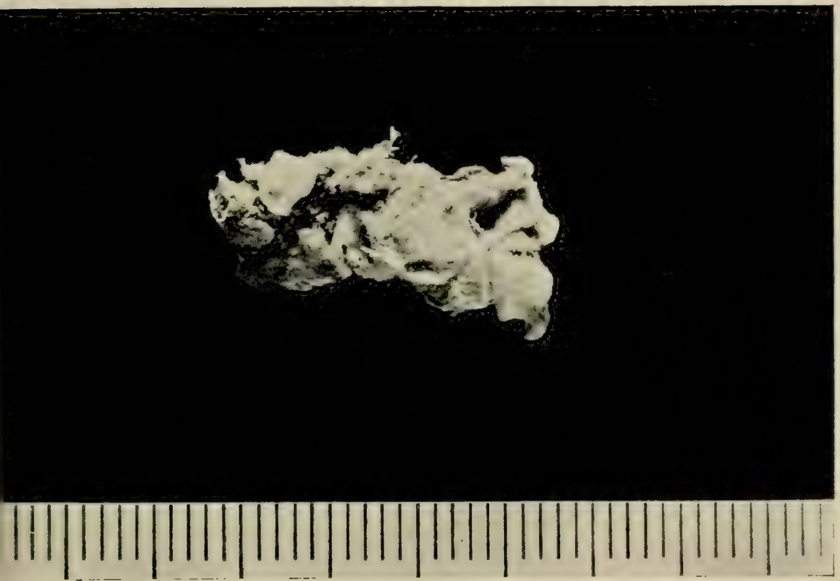


PLATE 40

Fig. 79. *Carmia contax,* new species, same as Fig. 78, enlarged with sigmas and occasional chelas showing. x 370.

Fig. 80. *Carmia contax,* new species, profile view of large chela and sigma. x 370. The sizes of chelas and toxas also show. x 370.

PLATE 41

Fig. 81. *Carmia contax,* new species, full view of a palmate anisochela. x 770.

Fig. 82. *Carmia fascifibula* (Topsent).

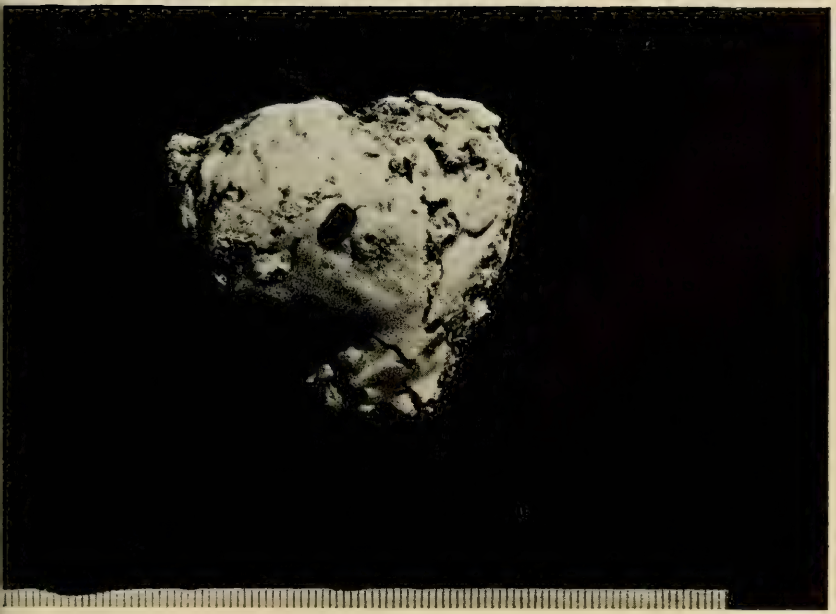


PLATE 42

Fig. 83. *Carmia fascifibula* (Topsent), vague netlike arrangement of tylostyles. x 50.

Fig. 84. *Carmia fascifibula,* profile of palmate anisochela, with heads of styles showing. x 370.

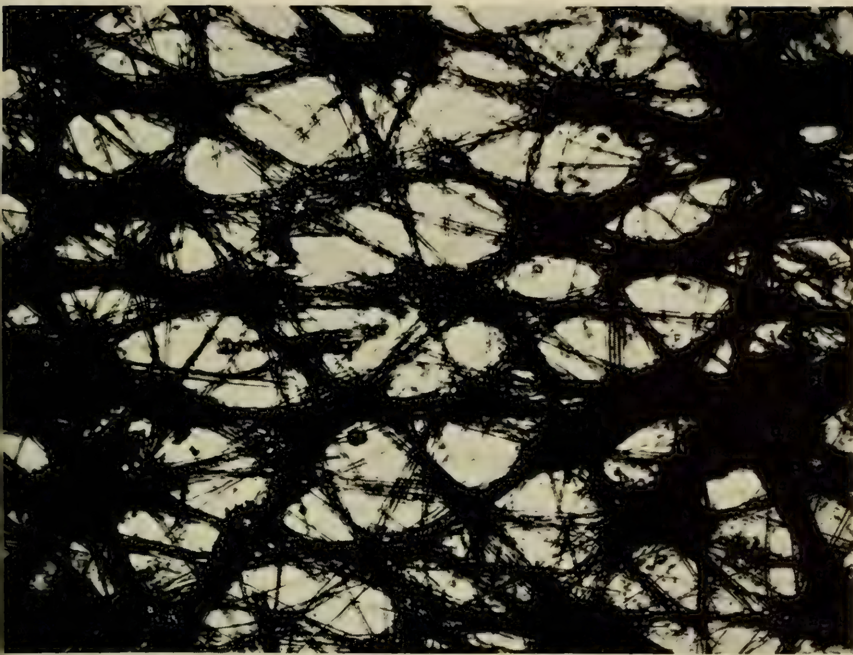


PLATE 43

Fig. 85. *Microtylostylifer partida,* new species.

Fig. 86. *Microtylostylifer partida,* new species, longitudinal section showing gross structure.

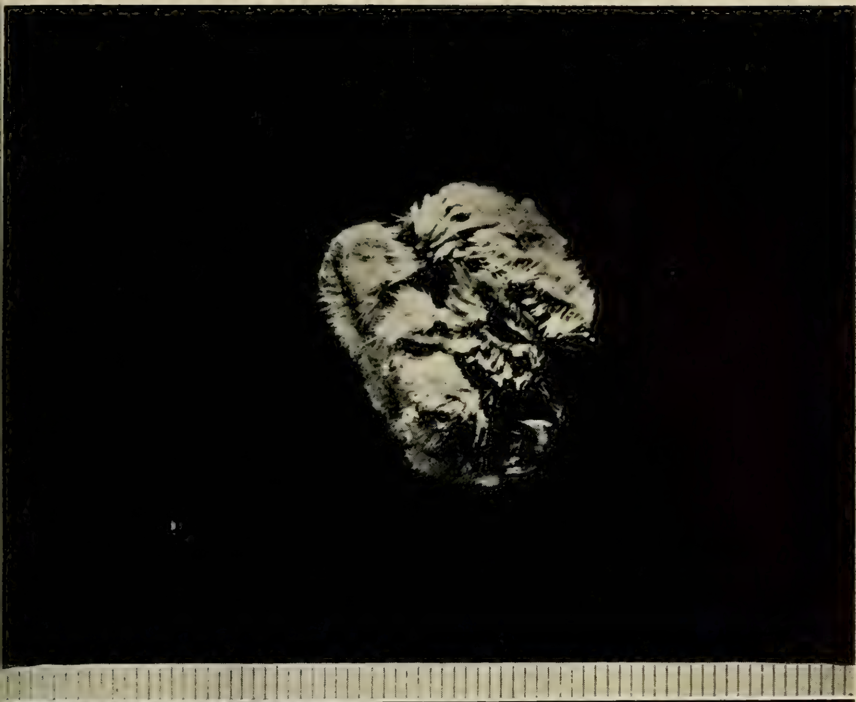
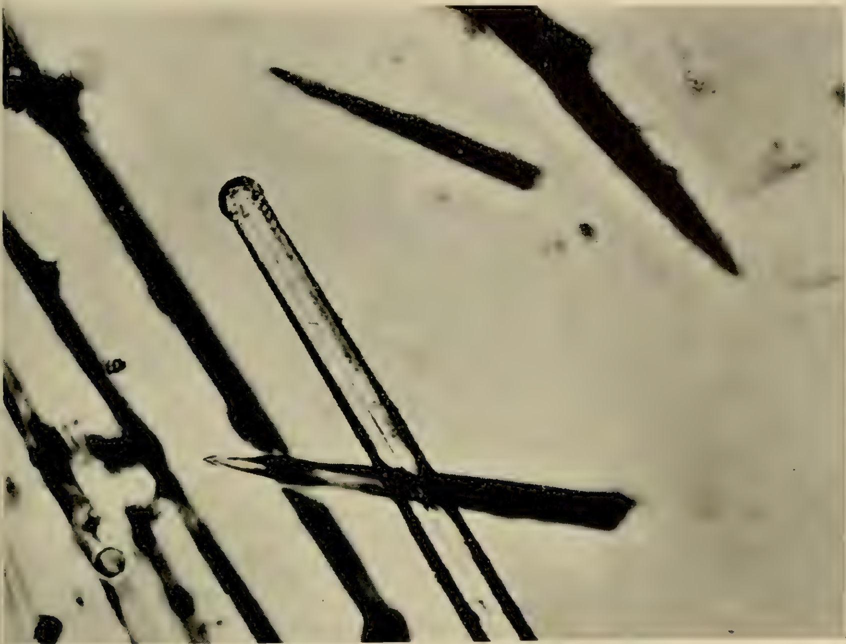


PLATE 44

Fig. 87. *Microtylostylifer partida,* new species, head of one tylostyle and the point of another. x 200.

Fig. 88. *Biemna rhadia* de Laubenfels.



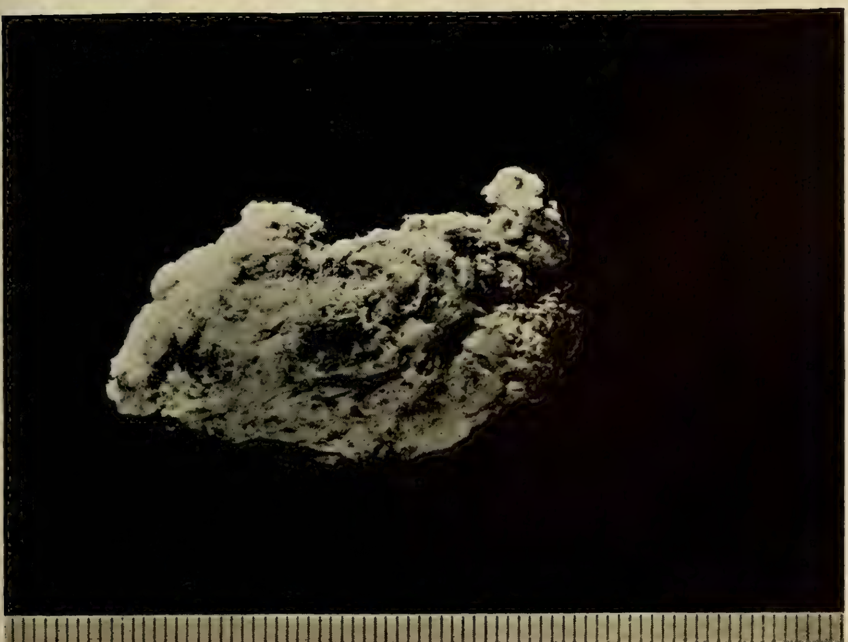


PLATE 45

Fig. 89. *Biemna rhadia* de Laubenfels, showing the tremendous size range of sigmas.

Fig. 90. *Axinella mexicana* de Laubenfels.

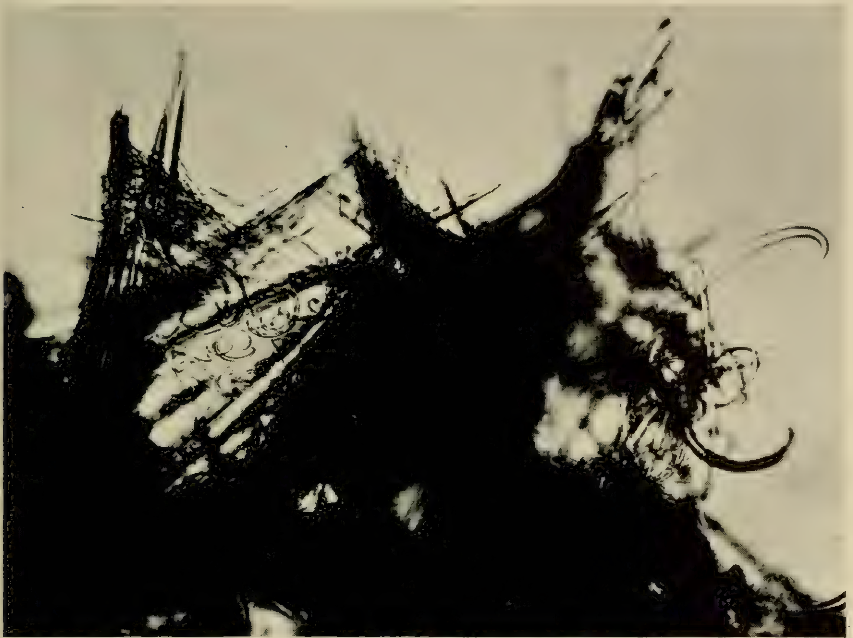


PLATE 46

Fig. 91. *Axinella mexicana* de Laubenfels, typical oxeas. x 200.
Fig. 92. *Axinella mexicana* de Laubenfels, a group of styles. x 200.

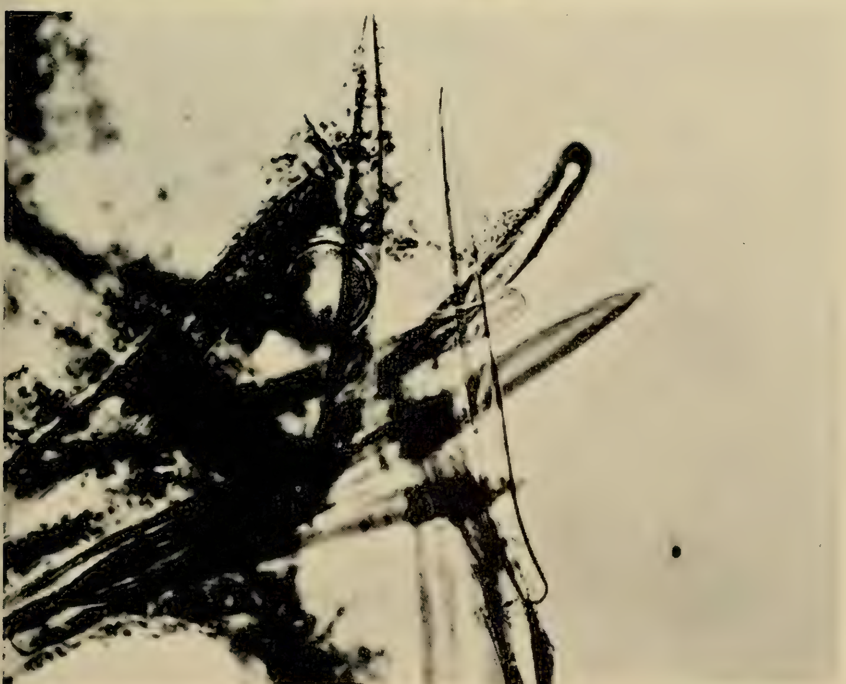


PLATE 47

Fig. 93. *Dragmacidon opisclera* de Laubenfels.

Fig. 94. *Dragmacidon opisclera* de Laubenfels, a typical group of styles. x 100.

PLATE 48

Fig. 95. *Dragmacidon opisclera* de Laubenfels, styles in tufts. x 110.
Fig. 96. *Thieleia rubiginosa* (Thiele).

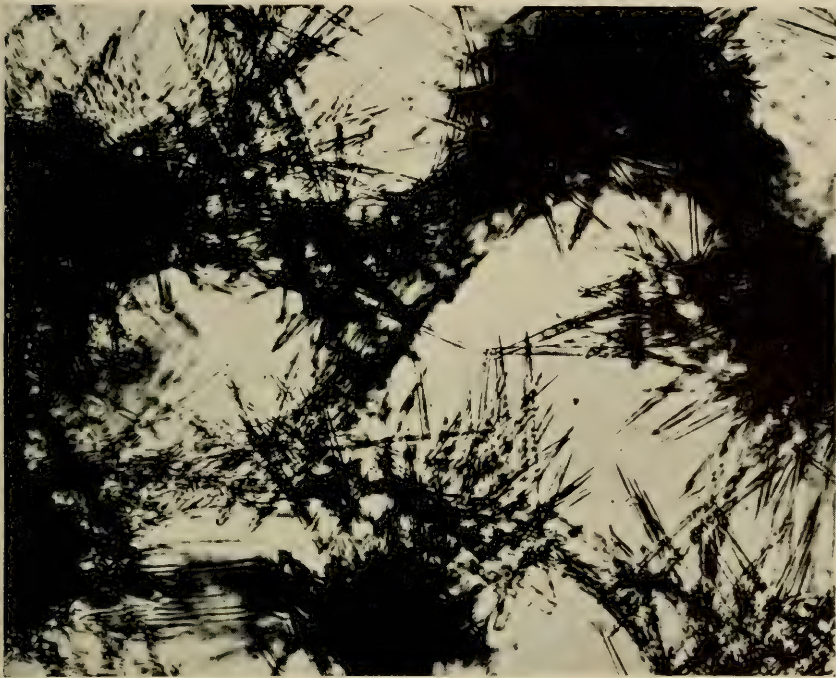


PLATE 49

Fig. 97. *Thieleia rubiginosa* (Thiele), a longitudinal section.
Fig. 98. *Higginsia higginissima,* new species.

PLATE 50

Fig. 99. *Higginsia higginissima,* new species, longitudinal section.
Fig. 100. *Higginsia higginissima,* new species, spiny strongyles. x 770.

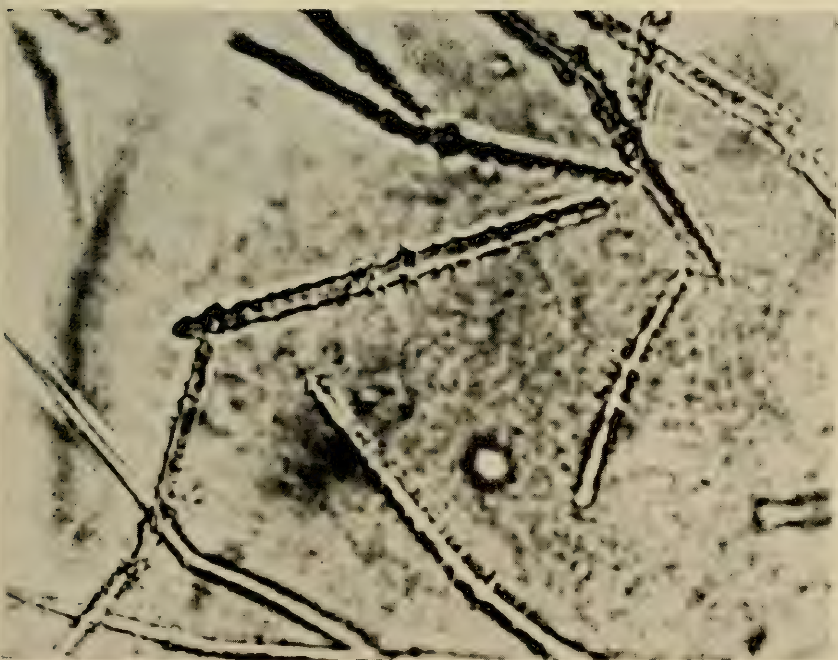


PLATE 51

Fig. 101. *Higginsia higginissima,* new species, spiny centrotylote. x. 770.
Fig. 102. *Halichondria panicea* (Pallas).

PLATE 52

Fig. 103. *Halichondria panicea* (Pallas), tangentially placed oxeas of the dermal layer. x 100.

Fig. 104. *Rhaphoxya laubenfelsi,* new species. x 110.

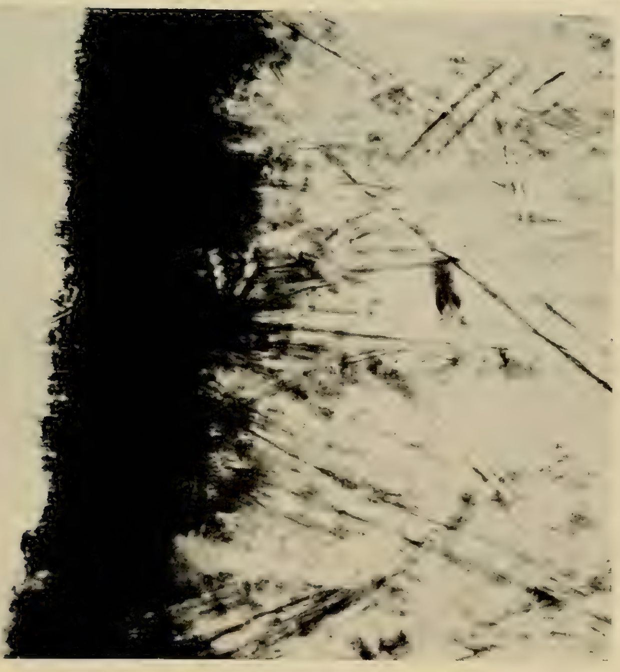


PLATE 53

Fig. 105. *Adreissa letra,* new species.

Fig. 106. *Adreissa letra,* new species, cross-section of Fig. 105, showing thin membrane over cavities.

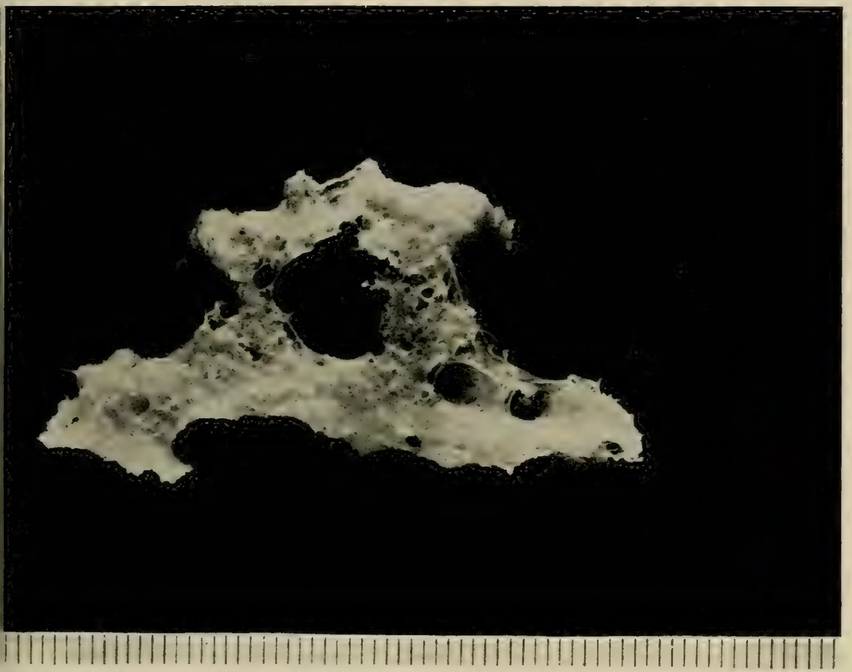


PLATE 54

Fig. 107. *Adreissa letra,* new species, aspiculous membrane. x 100.
Fig. 108. *Adreissa letra,* new species, styles. x 100.

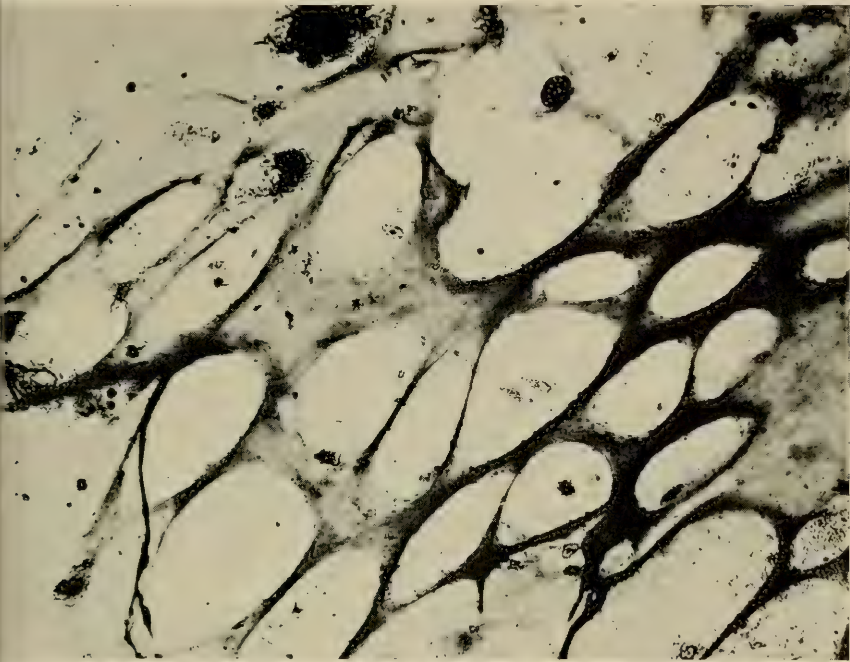


PLATE 55

Fig. 109. *Hymeniacidon adreissiformies,* new species.

Fig. 110. *Hymeniacidon adreissiformies,* new species, a close-up of the surface.

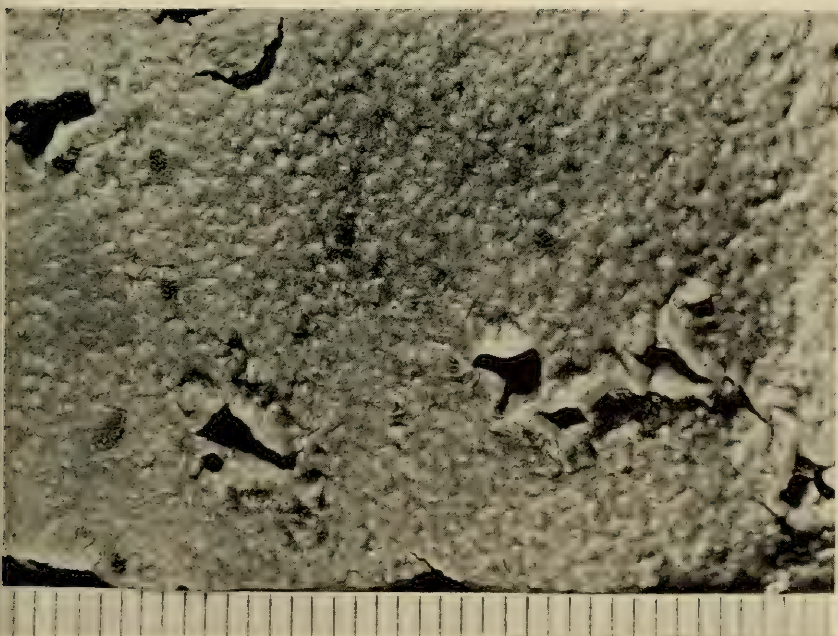


PLATE 56

Fig. 111. *Hymeniacidon adreissiformies,* new species, styles. x 430.
Fig. 112. *Hymeniacidon sinapium* de Laubenfels.

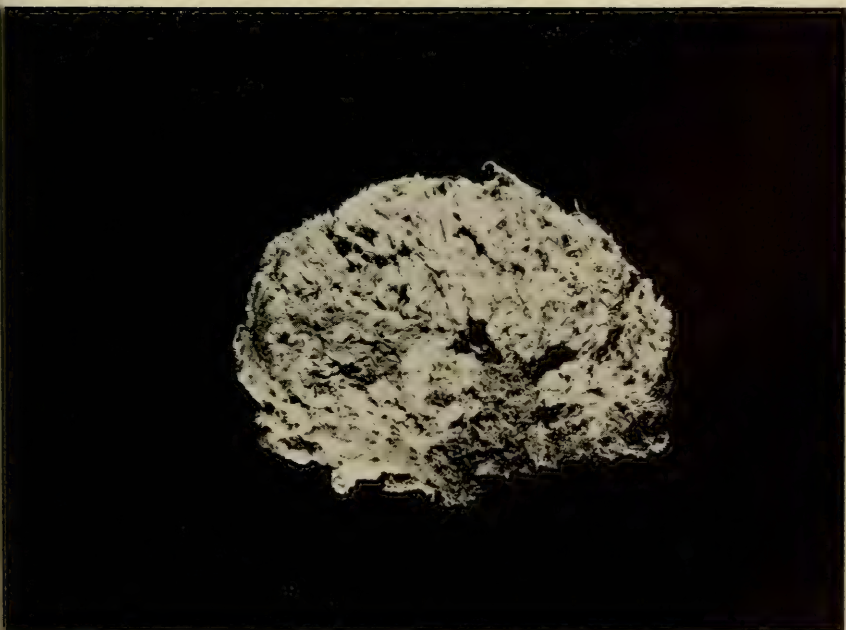


PLATE 57

Fig. 113. *Oxeostilon oxeon,* new species.
Fig. 114. *Oxeostilon oxeon,* new species, profile.

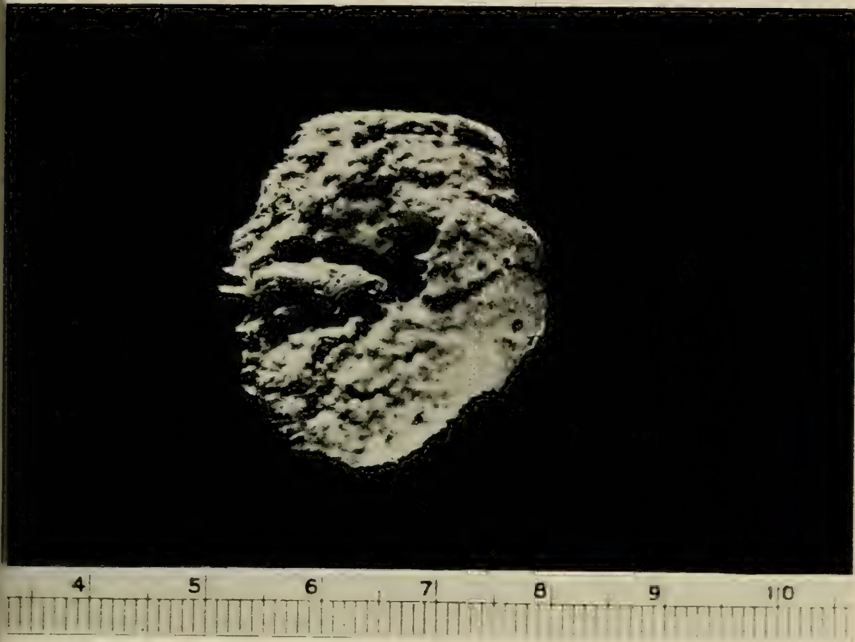

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PLATE 58

Fig. 115. *Oxeostilon oxeon,* new species, looking down on the surface.
Fig. 116. *Oxeostilon oxeon,* new species, oxeas and styles. x 50.

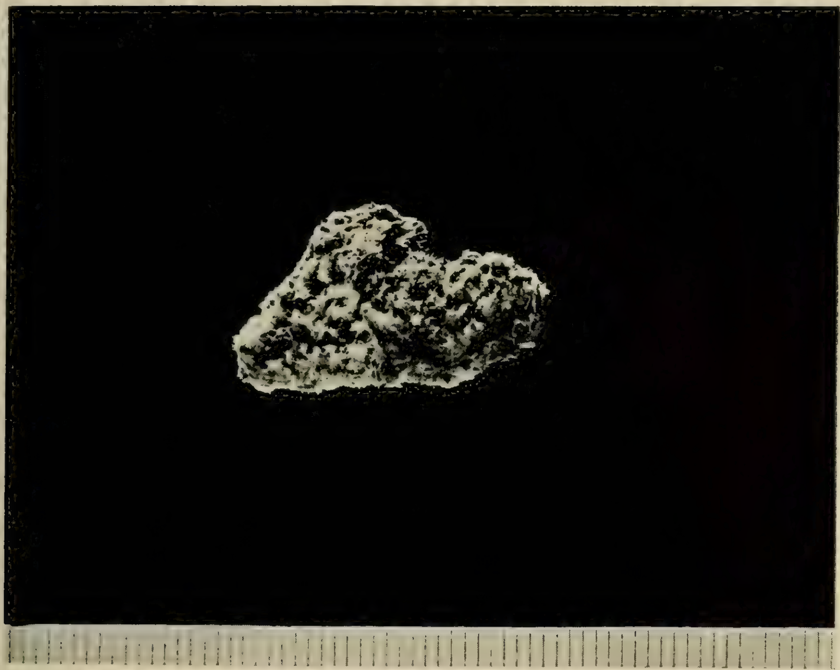

PLATE 59

Fig. 117. *Oxeostilon burtoni* de Laubenfels.
Fig. 118. *Choanites mineri* de Laubenfels.

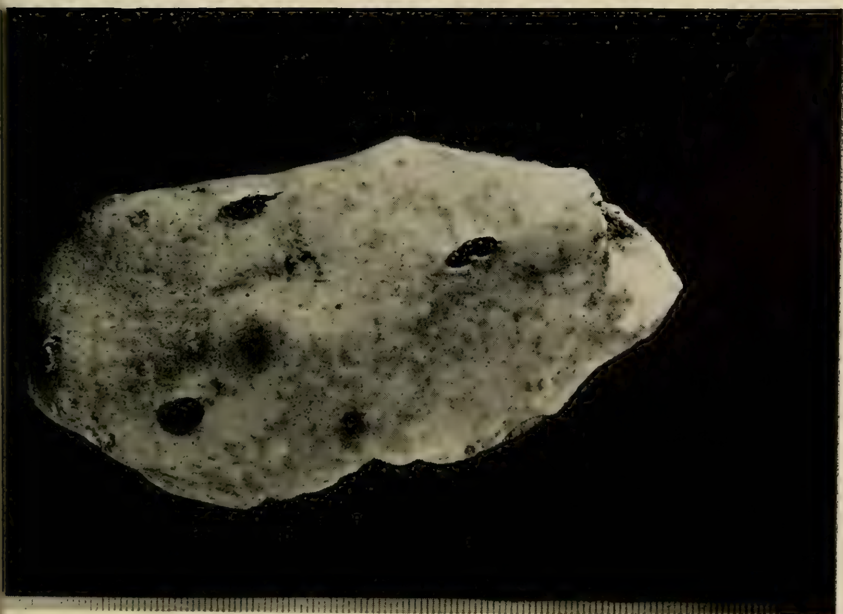

PLATE 60

Fig. 119. *Choanites mineri* de Laubenfels, close-up of oscular opening.
Fig. 120. *Choanites mineri* de Laubenfels, growing on a seaweed.

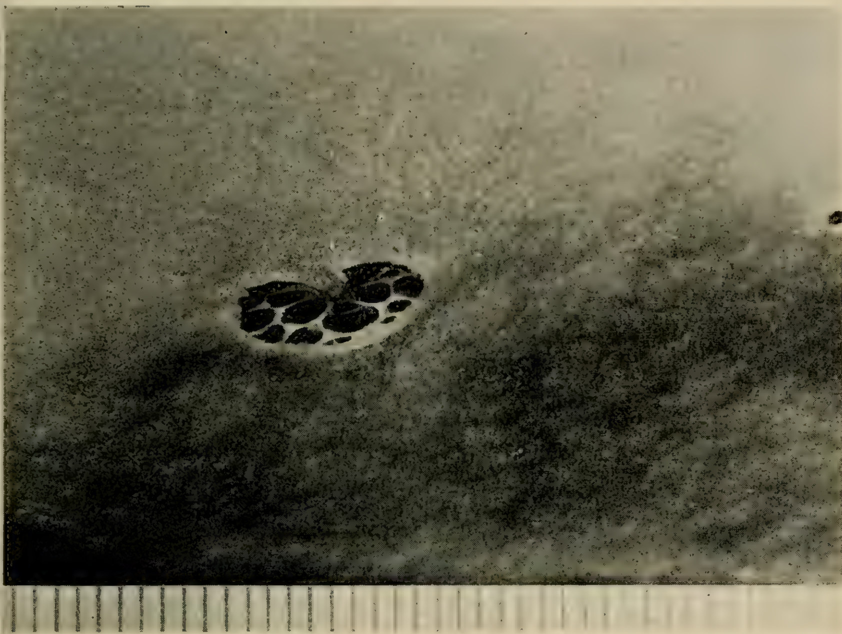


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PLATE 61

Fig. 121. *Choanites mineri* de Laubenfels, a tylostyle and a centrotylote microstrongyle. x 770.

Fig. 122. *Delaubenfelsia raromicrosclera,* new species.

PLATE 62

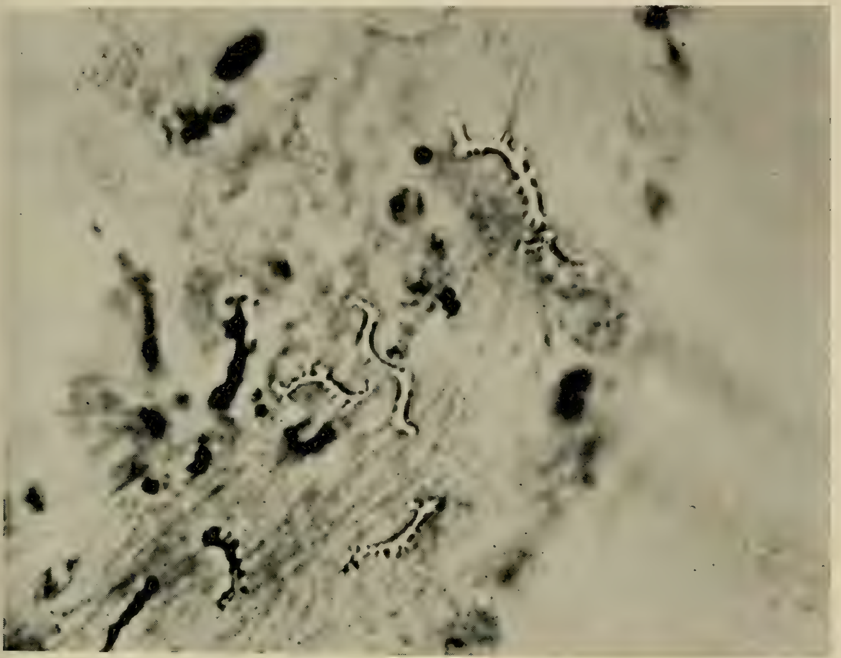
Fig. 123. *Delaubenfelsia raromicrosclera,* new species, tylostyle. x 200.

Fig. 124. *Delaubenfelsia raromicrosclera,* new species, tylostyles with microscleres in background. x 200.

PLATE 63

Fig. 125. *Delaubenfelsia raromicrosclera,* new species, microscleres. x 770.

Fig. 126. *Delaubenfelsia raromicrosclera,* new species, a single microsclera. x 770.



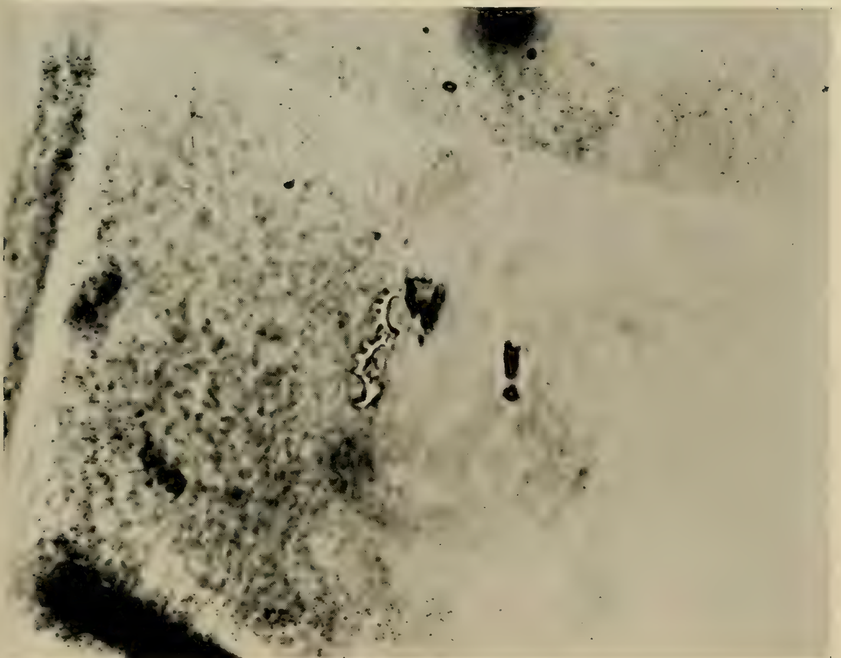
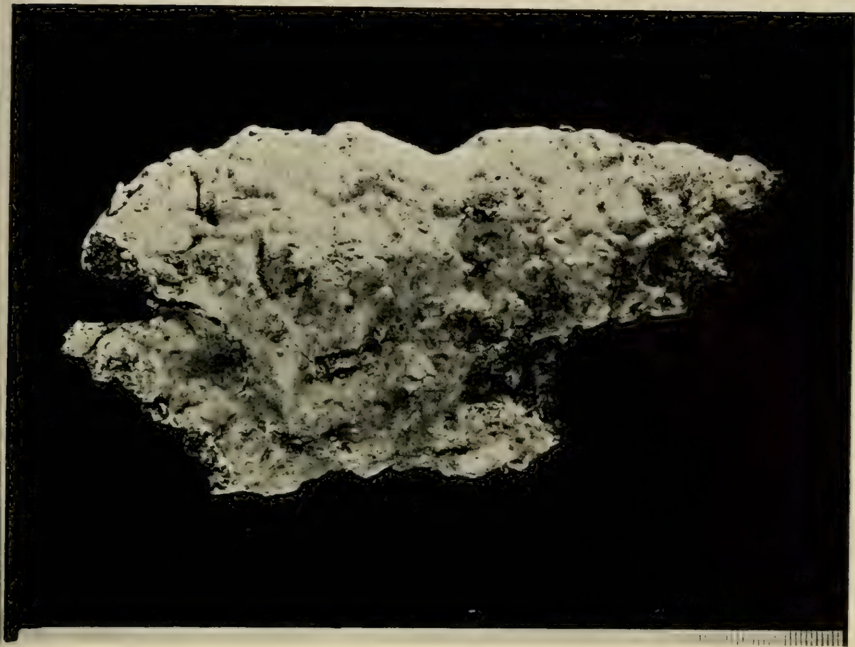


PLATE 64

Fig. 127. *Spirastrella coccinea* (Duchassaing and Michelotti).

Fig. 128. *Spirastrella coccinea* (Duchassaing and Michelotti), a close-up of pore area.



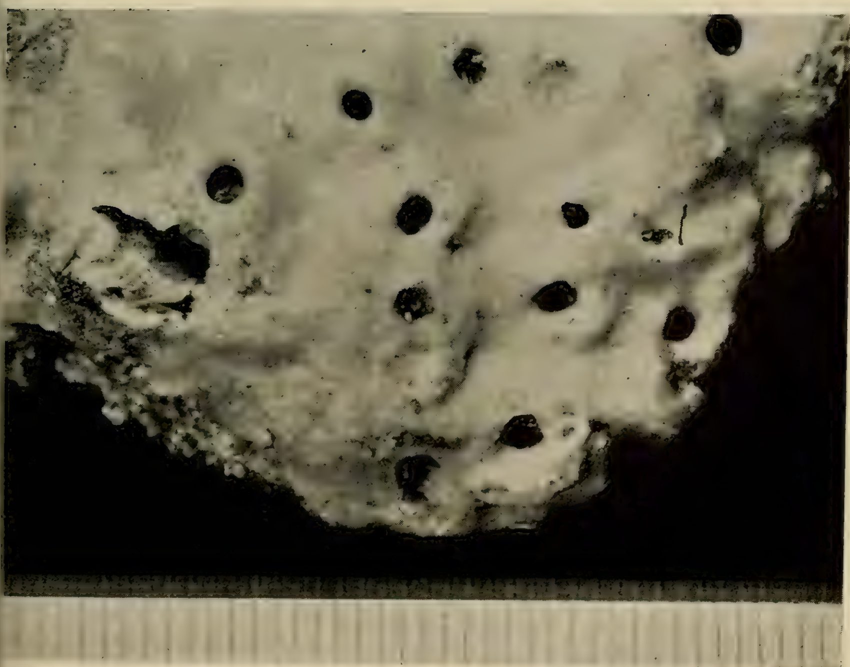


PLATE 65

Fig. 129. *Spirastrella coccinea* (Duchassaing and Michelotti), tylostyle. x 100.

Fig. 130. *Spirastrella coccinea* (Duchassaing and Michelotti), spirasters. x 770.

PLATE 66

Fig. 131. *Atergia corona,* new species.
Fig. 132. *Atergia corona,* new species, longitudinal section.

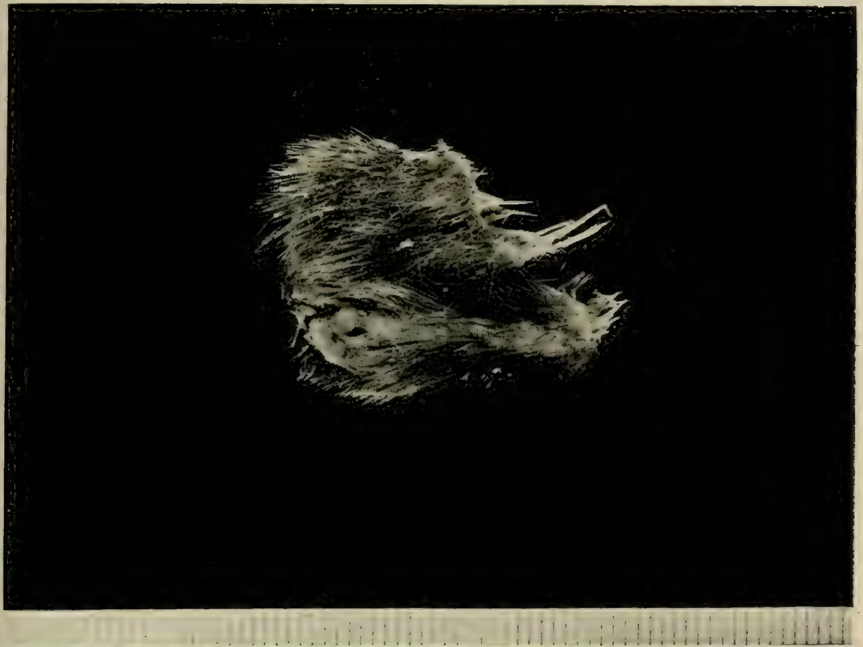


PLATE 67

Fig. 133. *Atergia corona,* new species, showing erect dermal tylostyles. x 50.

Fig. 134. *Laxosuberites rugosus* (Schmidt).

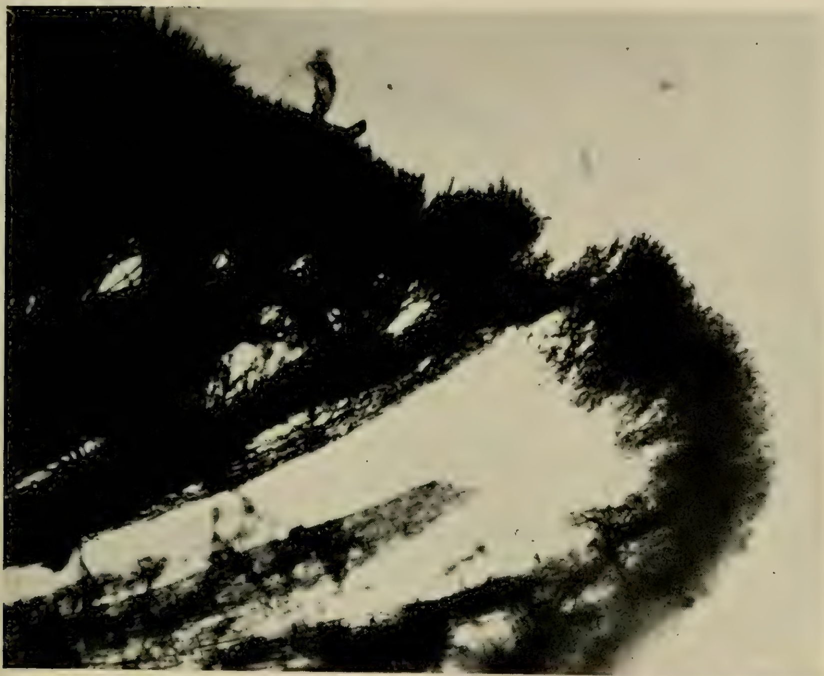


PLATE 68

Fig. 135. *Laxosuberites rugosus* (Schmidt), same with surface membrane removed.

Fig. 136. *Laxosuberites rugosus* (Schmidt), surface tuft of spicules arranged point upward. x 200.

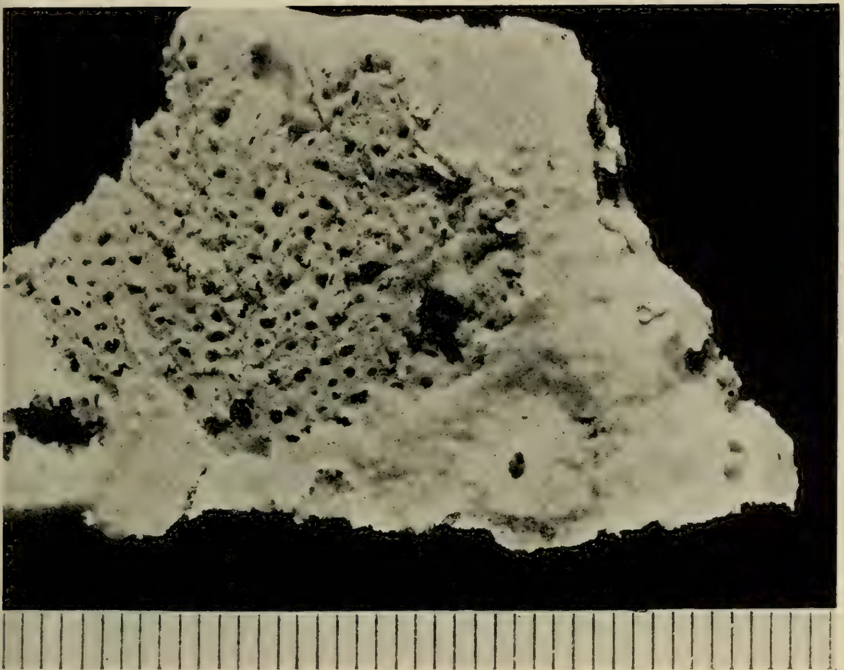


PLATE 69

Fig. 137. *Laxosuberites zeteki* de Laubenfels.

Fig. 138. *Laxosuberites zeteki* de Laubenfels, same from the side.

PLATE 70

Fig. 139. *Laxosuberites zeteki* de Laubenfels, typical tylostyle. x 200.
Fig. 140. *Pseudosuberites pseudos,* new species.

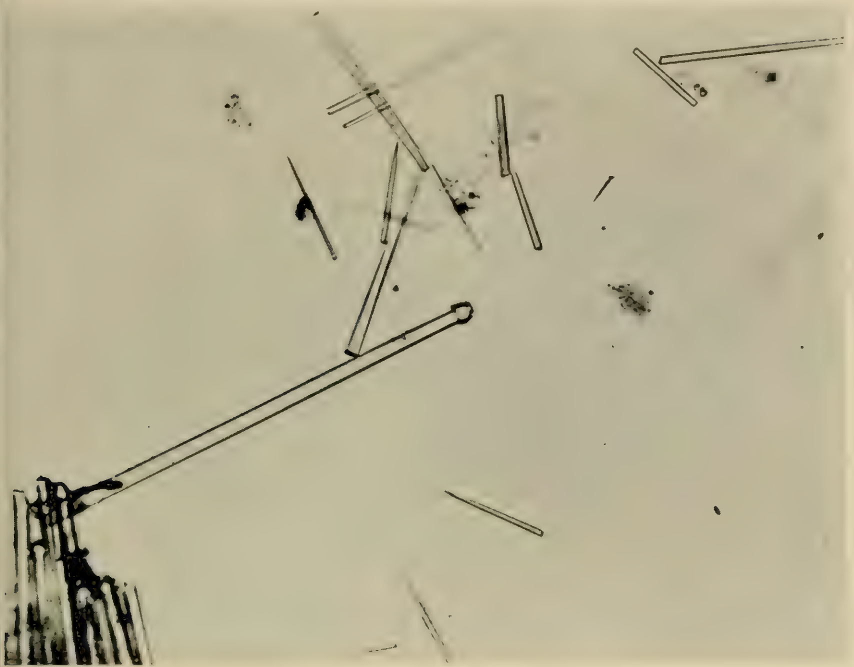


PLATE 71

Fig. 141. *Pseudosuberites pseudos,* new species, a portion of surface.

Fig. 142. *Pseudosuberites pseudos,* new species, a portion of surface showing closed oscules. x 3.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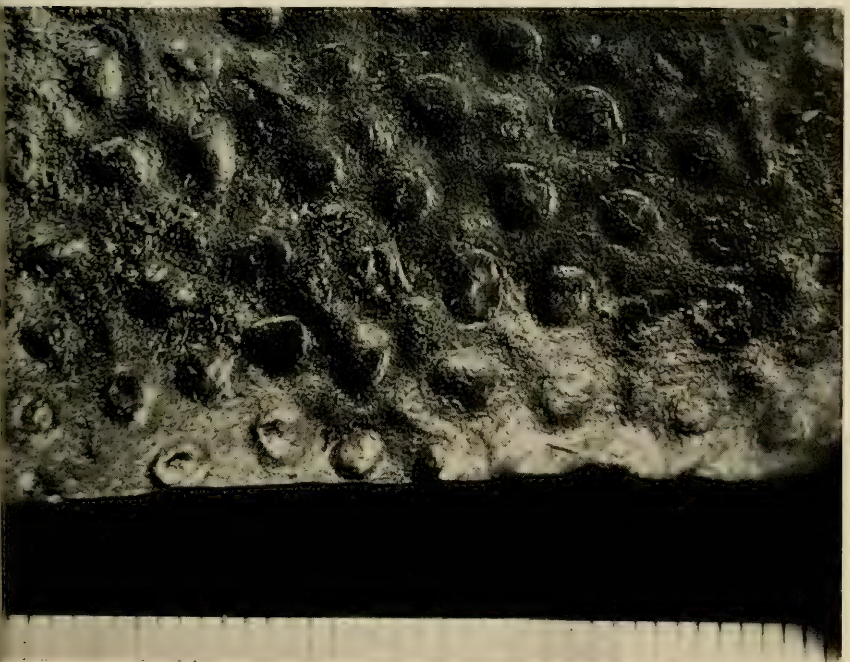
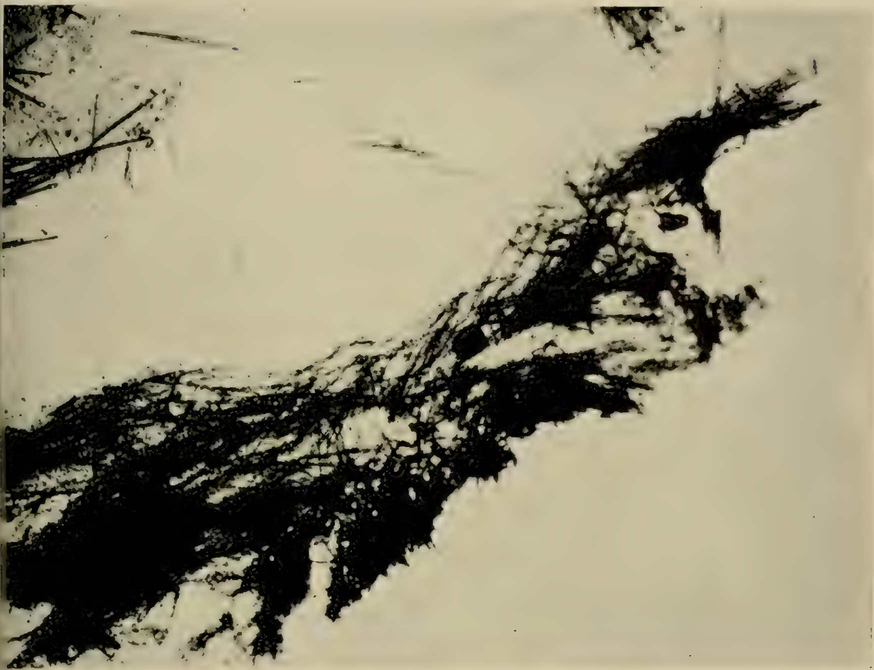


PLATE 72

Fig. 143. *Pseudosuberites pseudos,* new species, tangential layer of tylostyles in the dermis. x 50.

Fig. 144. *Pseudosuberites hyalina* (Ridley).



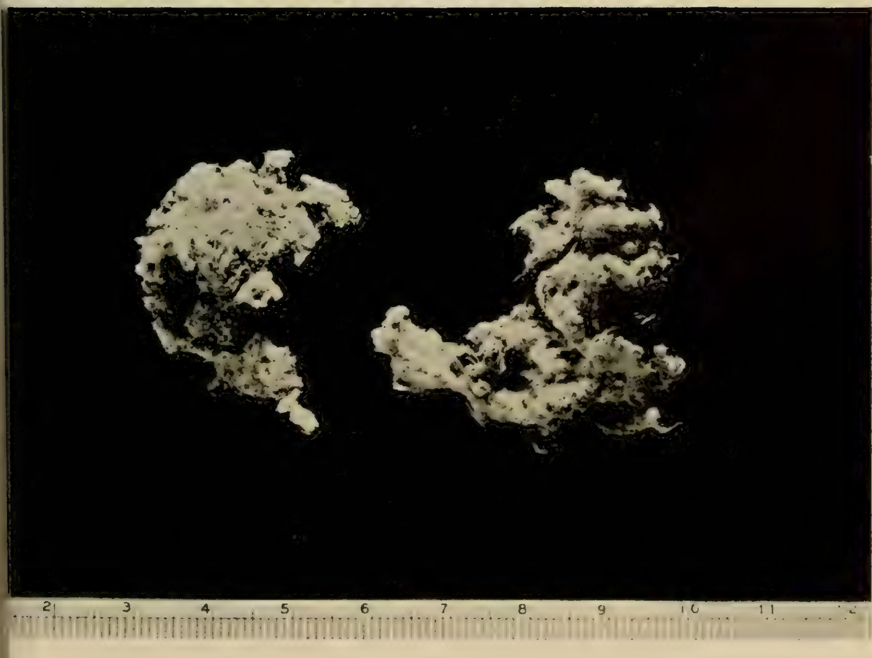

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PLATE 73

Fig. 145. *Pseudosuberites hyalina* (Ridley), tylostyles. x 100.
Fig. 146. *Epipolasis oxyspicula,* new species.

PLATE 74

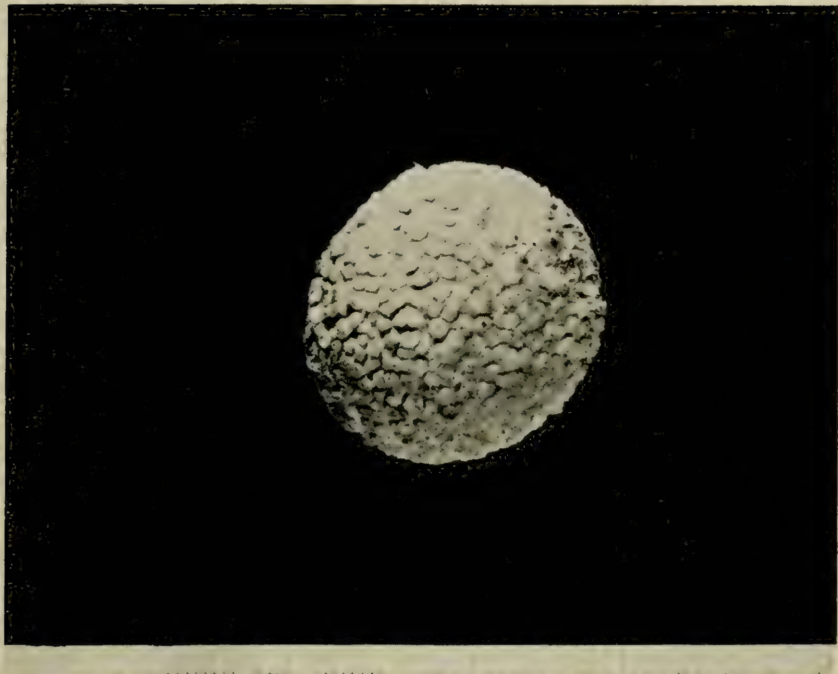
Fig. 147. *Epipolasis oxyspicula,* new species, longitudinal section showing the pigment concentration at the surface.

Fig. 148. *Epipolasis oxyspicula,* new species, showing a spicular column of twisted oxeas. x 110.

PLATE 75

Fig. 149. *Tethya aurantia* (Pallas).

Fig. 150. *Tethya aurantia* (Pallas), cross-section showing radial structure, the cortical region, and the denser central portion.



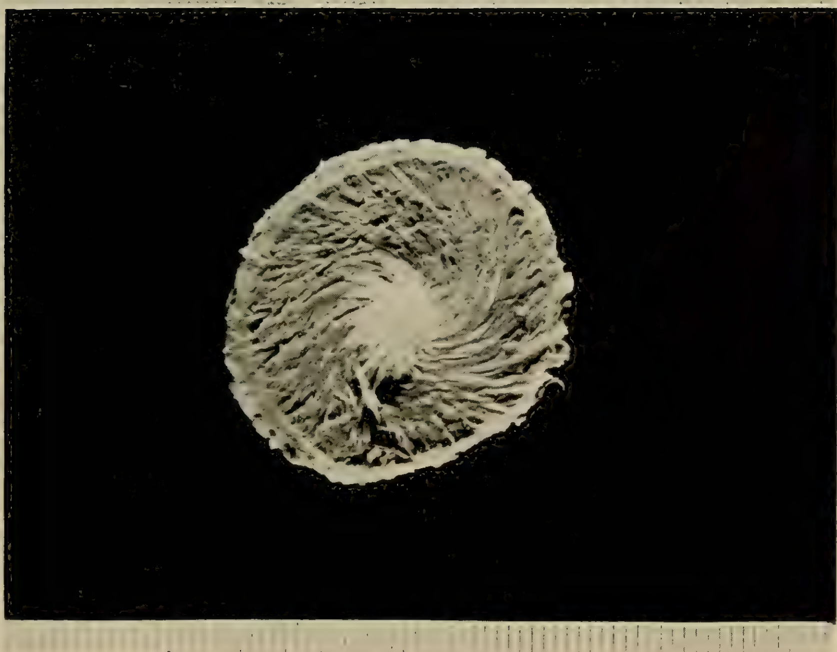


PLATE 76

Fig. 151. *Penares cortius* de Laubenfels.

Fig. 152. *Penares cortius* de Laubenfels, part of head of dichotriaene. x 100.

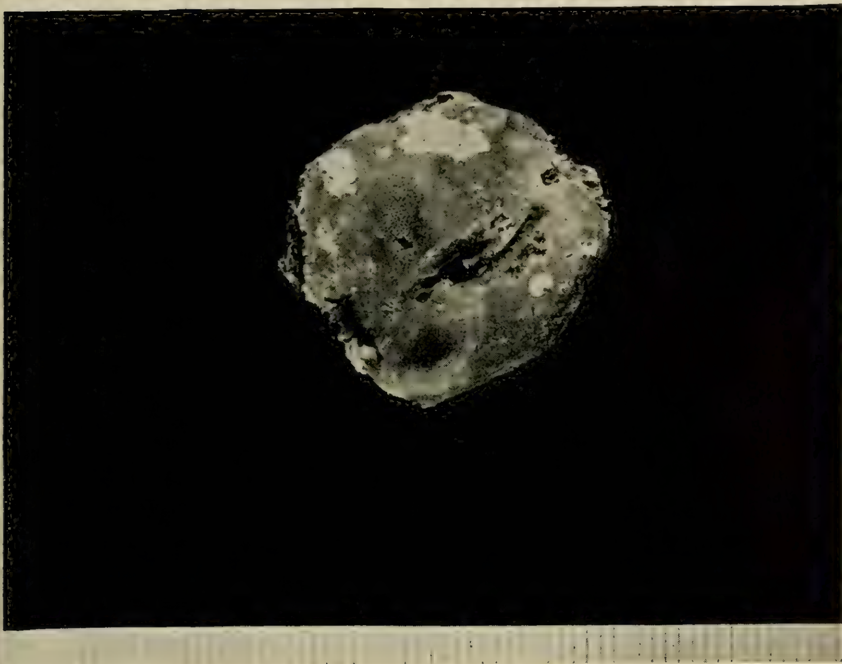


PLATE 77

Fig. 153. *Penares cortius* de Laubenfels, a small oxea. x 30.
Fig. 154. *Stelletta estrella* de Laubenfels.

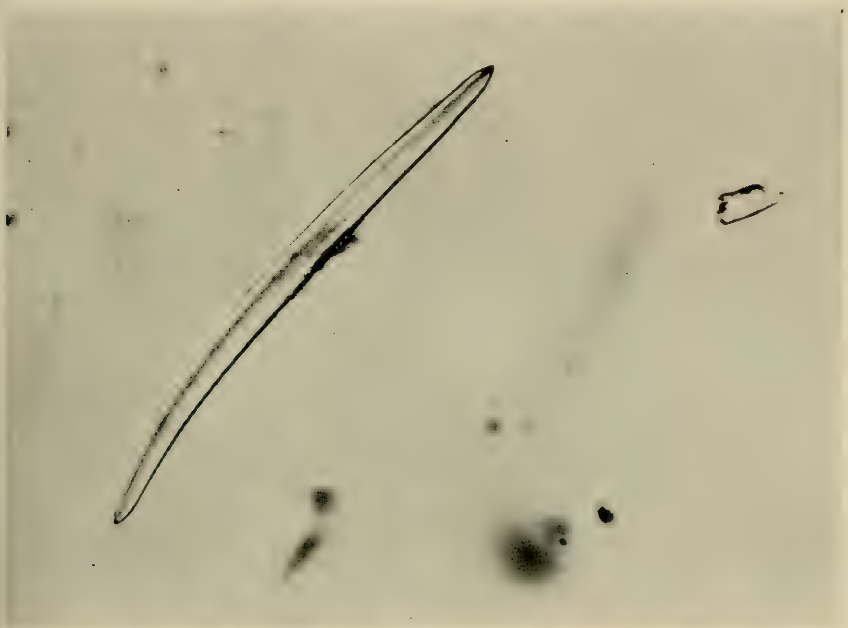


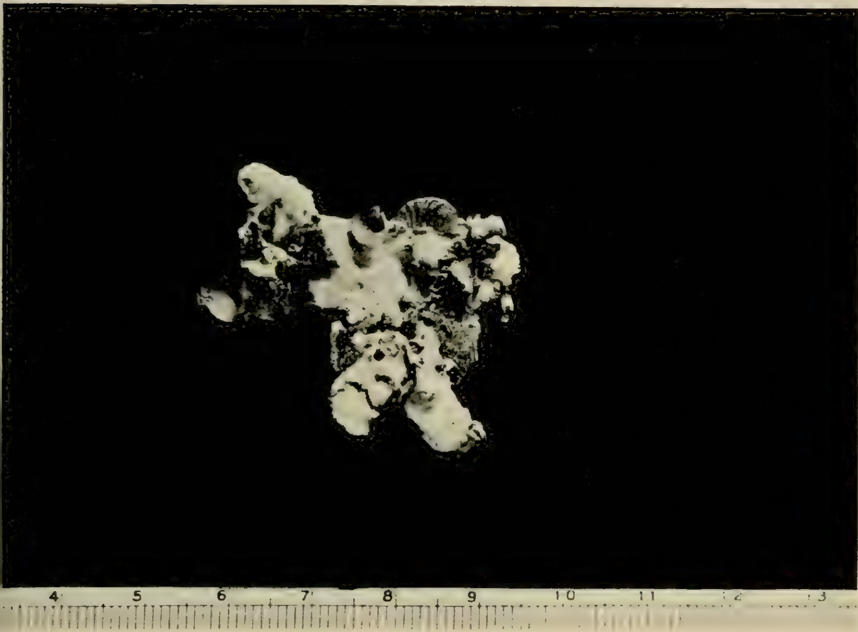
PLATE 78

Fig. 155. *Stelletta estrella* de Laubenfels, endosomal triaenes. x 100.
Fig. 156. *Stelletta estrella* de Laubenfels, tylospherasters. x 770.

PLATE 79

Fig. 157. *Erylus discastera,* new species.

Fig. 158. *Erylus discastera,* new species, disk-shaped sterraster forming the surface armor. x 110.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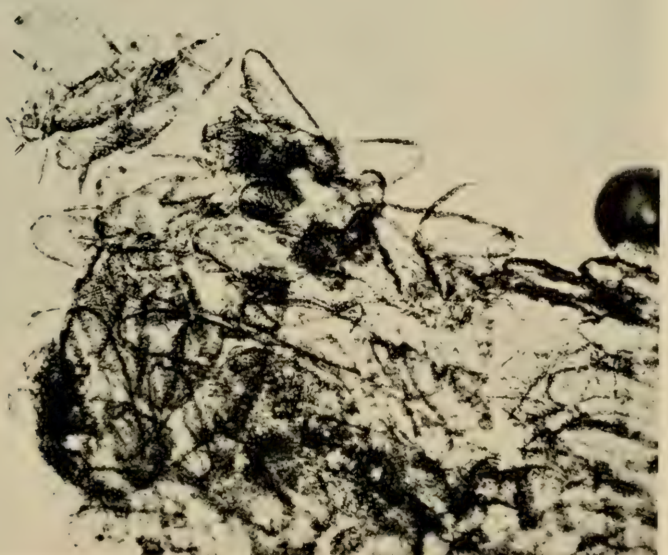


PLATE 80

Fig. 159. *Erylus discastera,* new species, characteristic sterraster. x 370.

Fig. 160. *Geodia mesotriaena* Lendenfeld.

PLATE 81

Fig. 161. *Geodia mesotriaena* Lendenfeld, showing special pore area.

Fig. 162. *Geodia mesotriaena* Lendenfeld, cross-section showing cortex and gross cavities.

PLATE 82

Fig. 163. *Geodia mesotriaena* Lendenfeld, one ray of the triaene showing the dicho modification. Sterrasters in the background. x 200.

Fig. 164. *Geodia mesotriaena* Lendenfeld, typical spherasters. x 200.

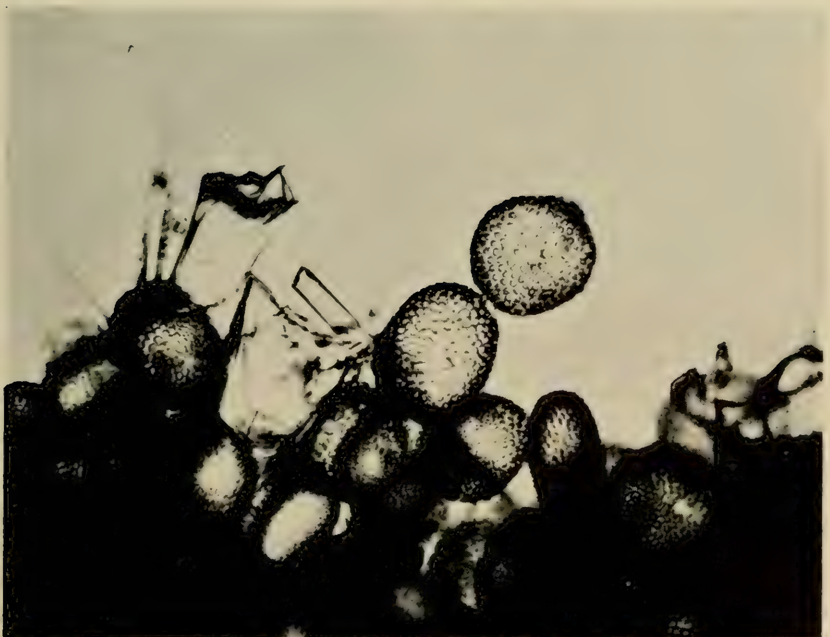


PLATE 83

Fig. 165. *Geodia japonica* (Sollas).
Fig. 166. *Geodia japonica* (Sollas), same with cortex removed.

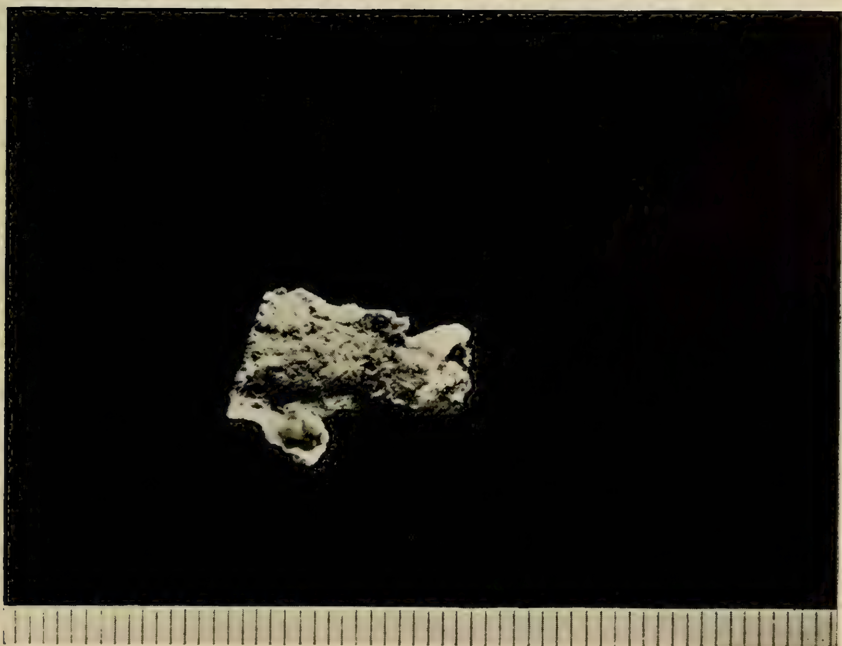


PLATE 84

Fig. 167. *Geodia japonica* (Sollas), a mass of spherasters and sterrasters. x 200.

Fig. 168. *Geodia japonica* (Sollas), spherasters faintly tylote. x 770.

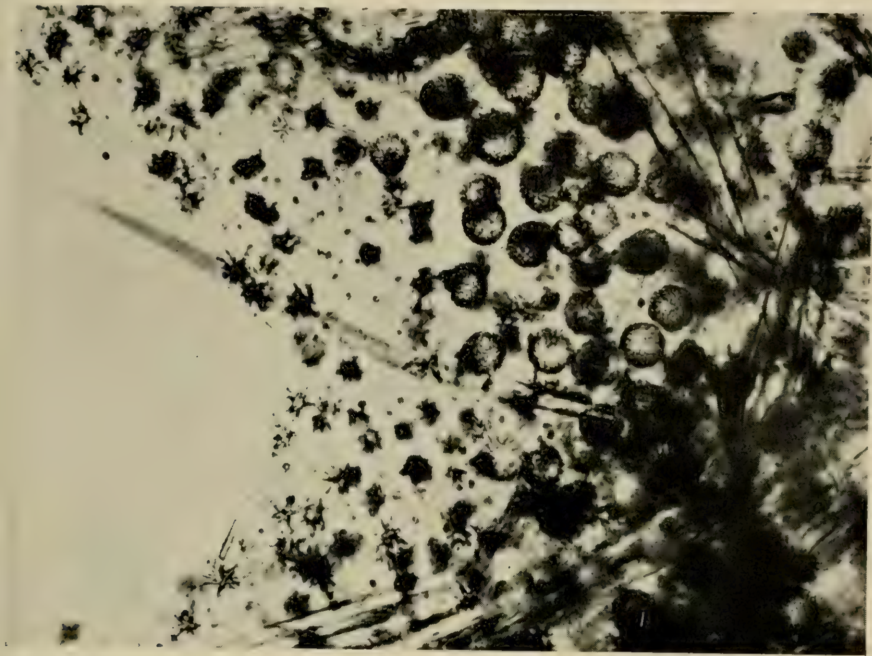


PLATE 85

Fig. 169. *Geodinella isabella,* new species.
Fig. 170. *Craniella arb* (de Laubenfels).

PLATE 86

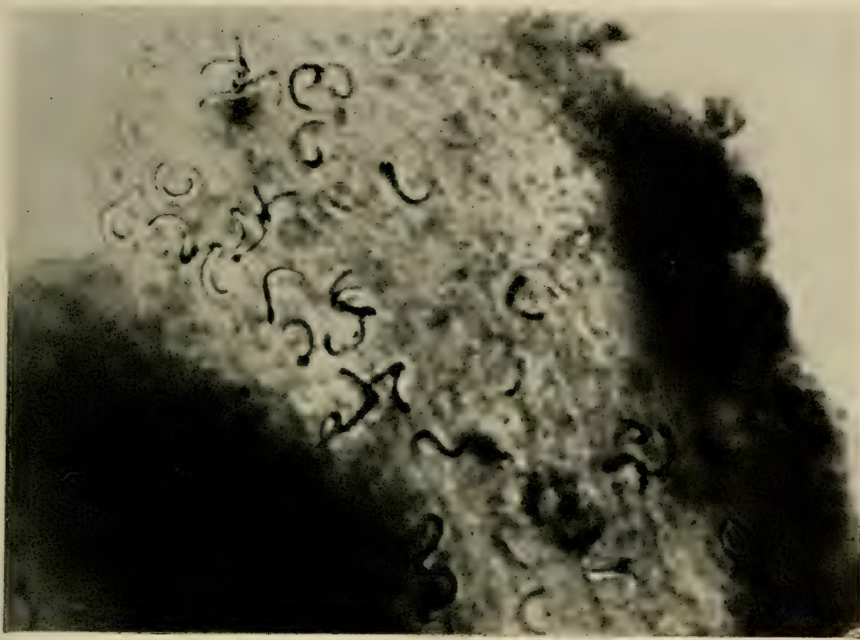
Fig. 171. *Craniella arb* (de Laubenfels), longitudinal section through the oscule showing the radial structure and denser central portion.

Fig. 172. *Craniella arb* (de Laubenfels), anatriaenes and protriaenes. x 100.

PLATE 87

Fig. 173. *Craniella arb* (de Laubenfels), characteristic spiny sigma-like microscleres. x 770.

Fig. 174. *Pachastrella dilifera* de Laubenfels.



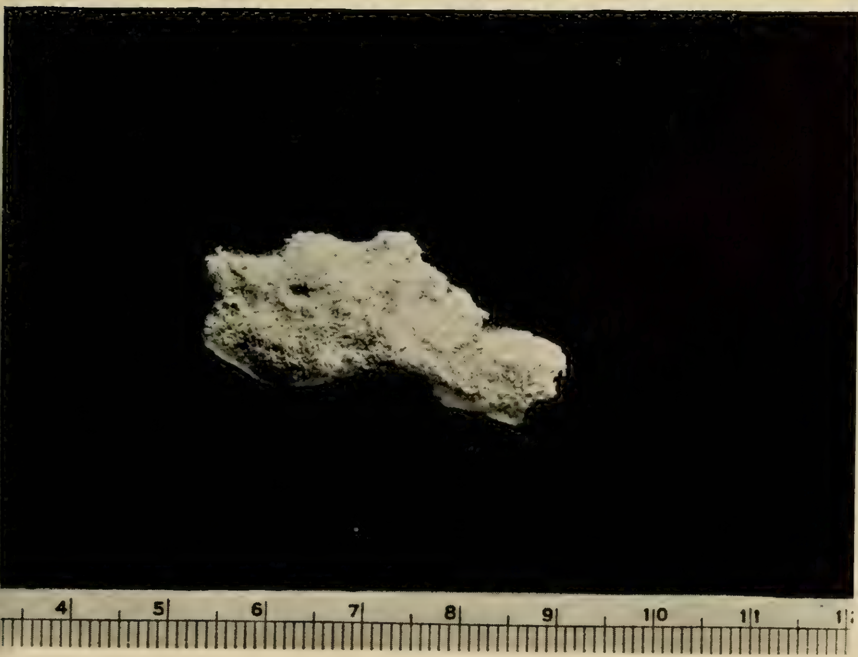

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PLATE 88

Fig. 175. *Pachastrella dilifera* de Laubenfels, typical calthrop. x 140.

Fig. 176. *Pachastrella multipora,* new species.

PLATE 89

Fig. 177. *Pachastrella multipora,* new species, with surface specialization removed.

Fig. 178. *Pachastrella multipora,* new species, cut edge showing specialization.

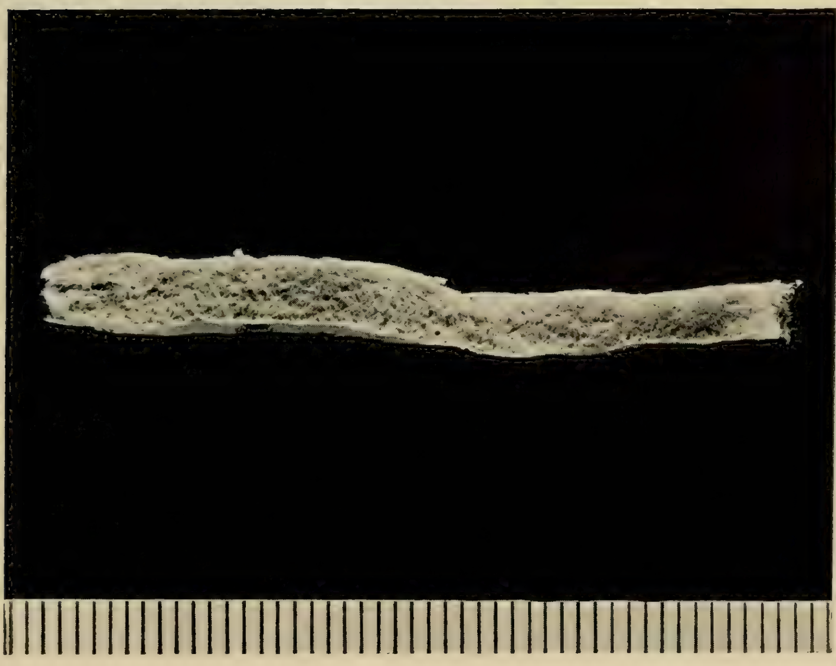


PLATE 90

Fig. 179. *Pachastrella multipora,* new species, calthrops. x 75.

Fig. 180. *Pachastrella multipora,* new species, showing the netlike arrangements of the oxea tracts. x 200.

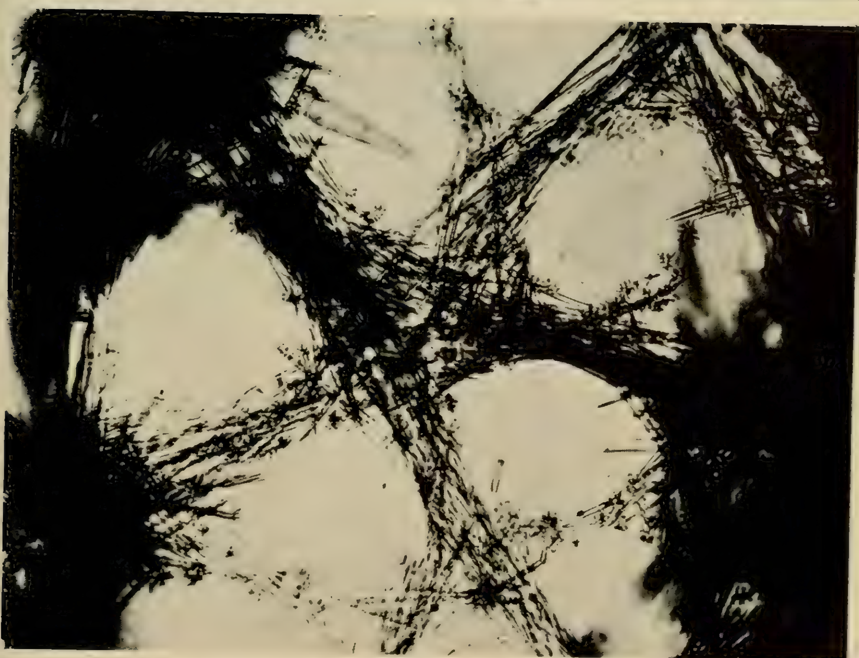
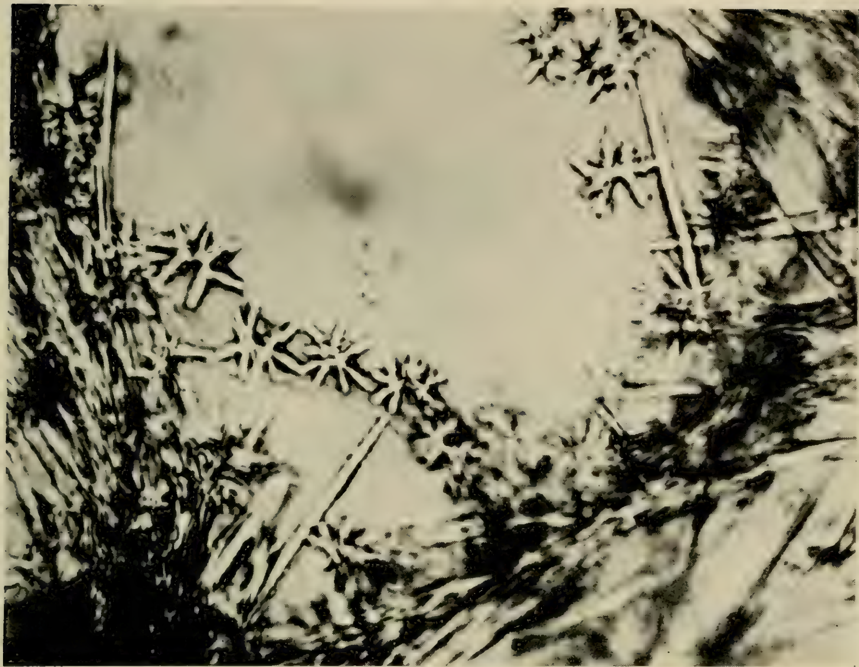


PLATE 91

Fig. 181. *Pachastrella multipora,* new species, and enlargement of Fig. 180, showing peculiar blunt-rayed spirasters. x 770.

Fig. 182. *Sphincterella osculanigera,* new species.



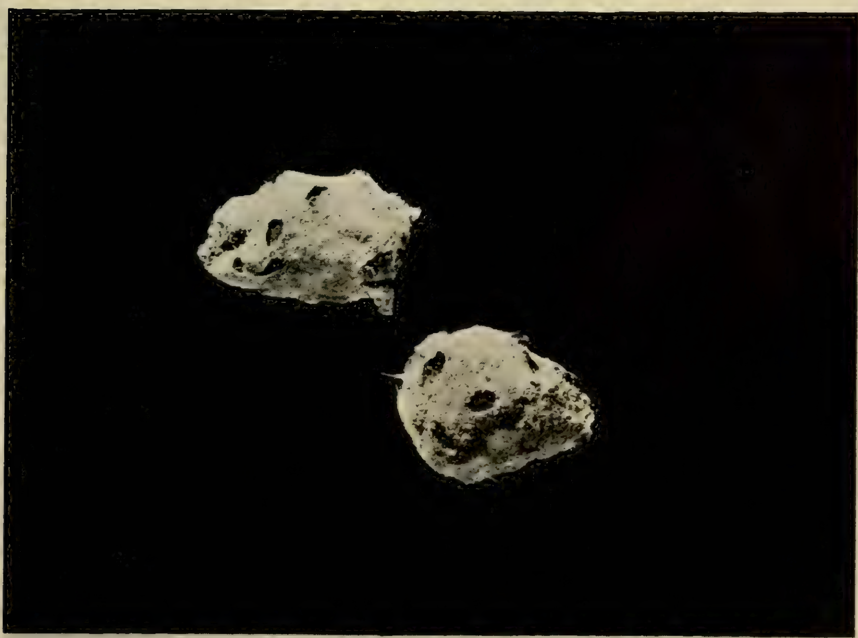


PLATE 92

Fig. 183. *Sphincterella osculanigera,* new species, enlarged to show the black sieve net over an oscule.

Fig. 184. *Sphincterella osculanigera,* new species, calthrops—one a triradiate and one with a reduced fourth ray. x 50.

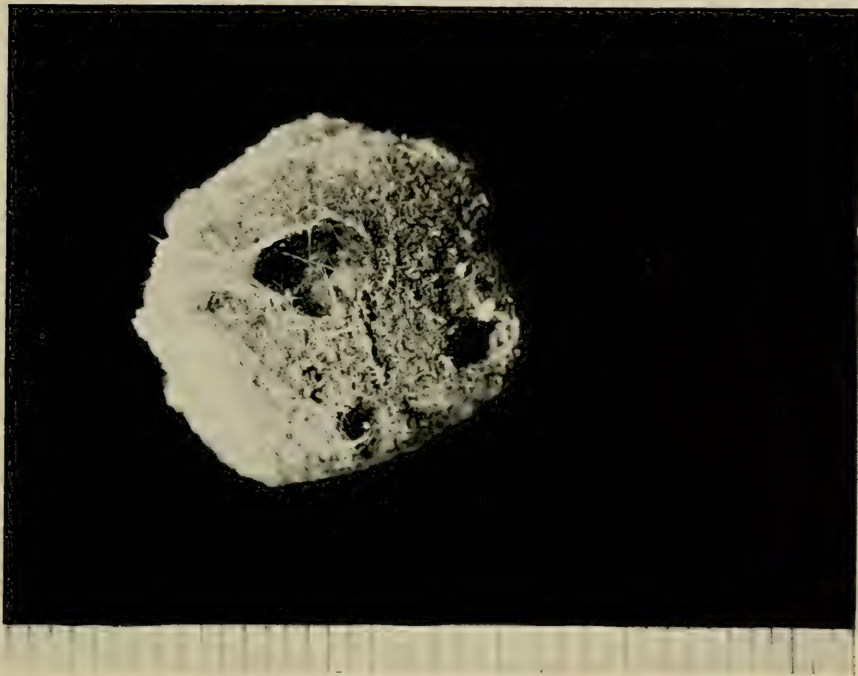


PLATE 93

Fig. 185. *Sphincterella osculanigera,* new species, oxeas with peculiar ringlike roughening characteristic of this species. x 200.

Fig. 186. *Poecillastra tenuilaminaris* Sollas, showing typical calthrop. x 100.

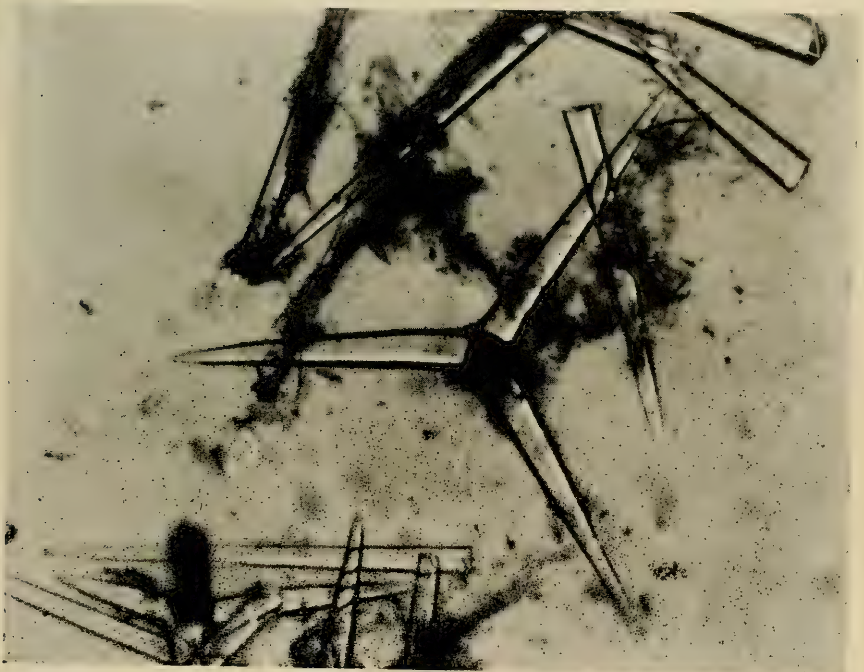
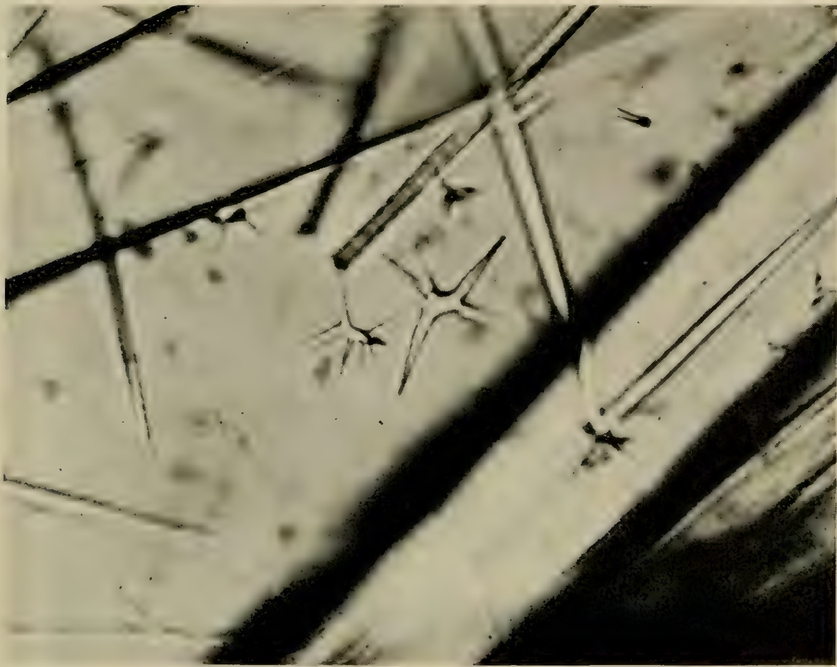


PLATE 94

Fig. 187. *Poecillastra tenuilaminaris* Sollas, plesiasters. x 770.
Fig. 188. *Leucetta losangelensis* de Laubenfels.



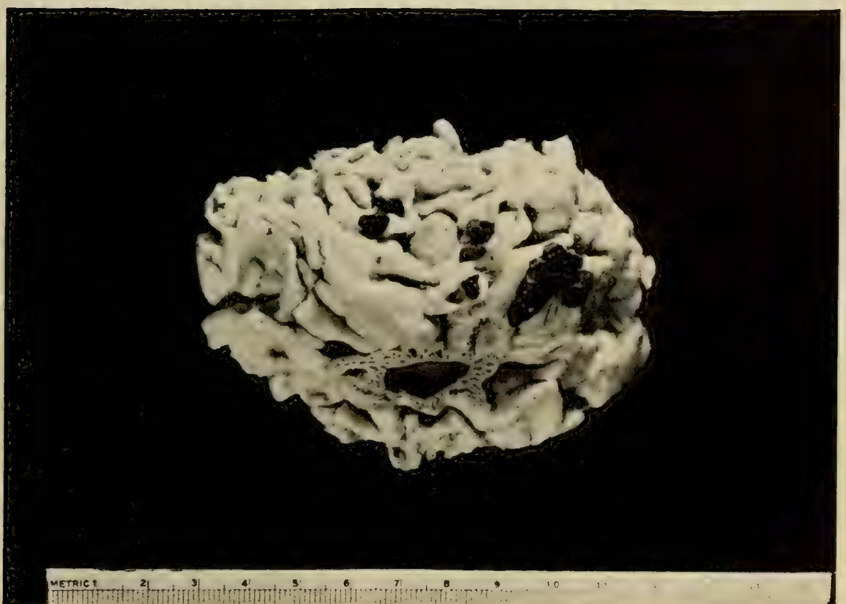

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PLATE 95

Fig. 189. *Leucetta losangelensis* de Laubenfels, longitudinal section showing gross internal structure.

Fig. 190. *Leucetta losangelensis* de Laubenfels, mass of triaxons typical of this species. x 100.

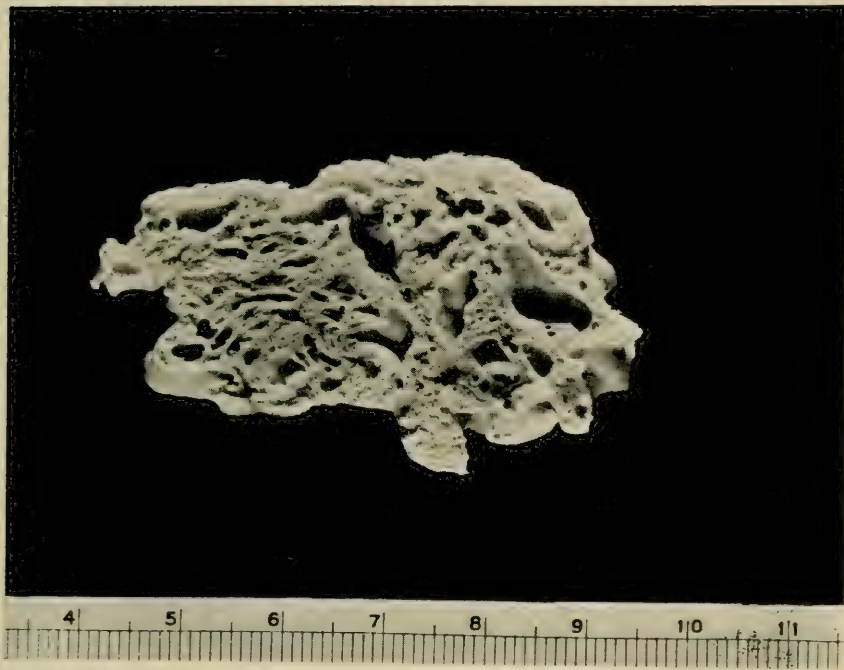
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PLATE 96

Fig. 191. *Leucetta losangelensis* de Laubenfels, another view of Fig. 190.
Fig. 192. *Leucosolenia irregularis* Jenkin.

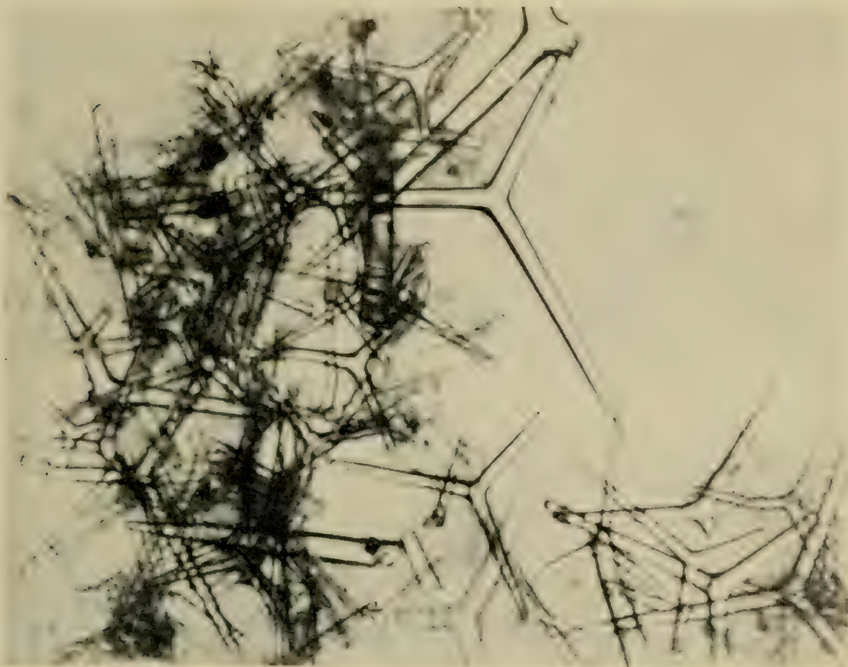


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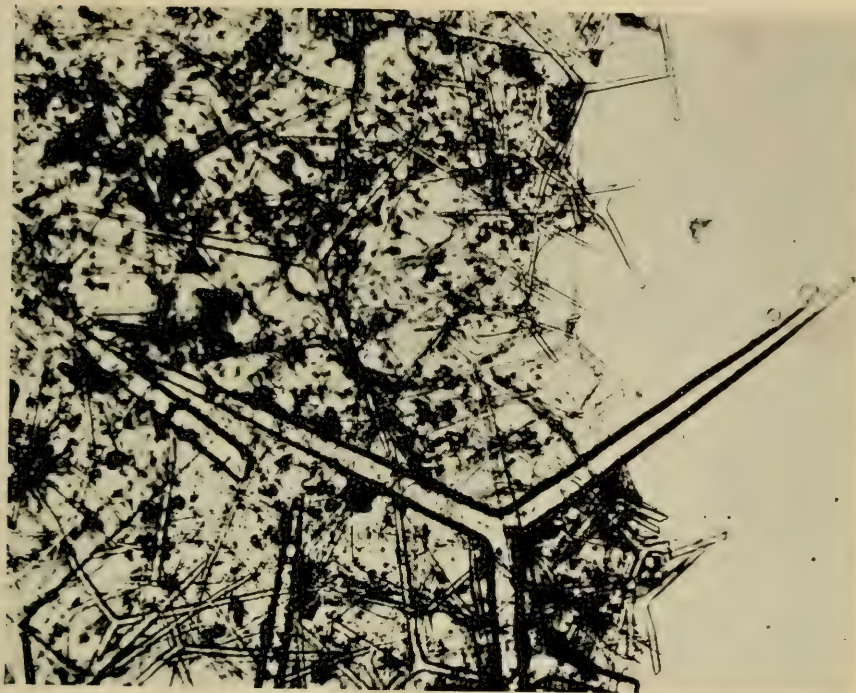
PLATE 97

Fig. 193. *Leucetta losangelensis* de Laubenfels, showing tremendous variation in size of the triaxons in this sponge. x 110.



THE HOLOTHURIOIDEA COLLECTED BY THE VELERO III AND IV DURING THE YEARS 1932 TO 1954

PART II. ASPIDOCHIROTA

(PLATES 1-9)

ELISABETH DEICHMANN

INTRODUCTION

No other tropical coast has ever been so well explored for shallow water holothurians as the Panamic region of the west coast of America, where the Hancock expeditions have collected for more than a decade. The report on the dendrochirotes, 1941, included about 40 species, of which many were new, and in most cases it was possible to outline the distribution for each species with some accuracy. The collections of aspidochirote forms are not so rich in species—only about half as many as the dendrochirotes, and few are new—but the enormous amount of material (some thousand individuals) has helped to clarify our ideas about these widespread forms, their distribution, their ecological demands, and the relationships of the Panamic shore fauna to that of the West Indies and the outposts of the West Pacific.

Like the dendrochirote forms, the aspidochirotes were almost unknown in that part of the world thirty years ago. Mortensen's few collecting trips in the Gulf of Panama, in 1916-1917, gave the first inkling of how much existed in that apparently barren region. One hesitated then to give names to these various species, as the few known forms were inadequately described and it seemed impossible that some of the more striking ones of those collected were not known from other parts of the world. Hence the publication of the report on his material was shelved for the time being.

A large amount of the Hancock material was identified in 1933, shortly after it had been collected, and more was worked over during my various visits to California in the following years. During this time short reports were published on material received from other expeditions (*Zaca*, *Arcturus*, *Stranger*, etc.), slowly adding to the handful of species hitherto listed. A preliminary report on the Hancock collections was

compiled and deposited in the Foundation during the war*. Finally, in the winter of 1954-55, I was given an opportunity to spend three months at the Hancock Foundation going through the entire collection and finishing the report.

I beg the authorities of the Hancock Foundation to accept my sincere thanks for the privilege of studying this unique collection, and for all the help and encouragement received during my most happy visit. In particular I wish to thank Captain Allan Hancock, whose unflagging interest in marine life has given an impetus to the study of the west coast invertebrates which can be compared only to that given by Alexander Agassiz through his *Albatross* expeditions in the latter part of the last century.

Station List

To eliminate duplication and the tedious work of co-ordinating widely scattered locality records, the stations are here arranged geographically instead of chronologically.

First on the list are placed the outlying islands, those which most likely have served as steppingstones for the Indo-West Pacific forms which have been able to cross the eastern Pacific: the Galapagos Islands, Cocos Island, and the Revilla Gigedo islands, Clarion and Socorro. The Clipperton Islands are not included as no aspidochirote holothurians were collected there by the Hancock expeditions, but they are mentioned under the distribution of the individual species. In the Galapagos Islands it has been found most practical to arrange the large number of stations alphabetically under each island, beginning with Albemarle and ending with Tower.

Along the mainland, the stations are arranged from south to north, the units being Peru, Ecuador, Colombia, Costa Rica, the exposed part

*A preliminary list was compiled by Domantay and, unfortunately, rather hurriedly published by him in 1953 without having any of the supposedly new records checked with older material. Of the genus *Holothuria* he lists 43 species and varieties, which subsequent examination has reduced to 20. His seven new species and varieties are complete *nomina nuda* with not even a locality record given, and these names must therefore be rejected once and for all. Most of the supposedly new forms, as well as the 16 older species hitherto known only from other parts of the world, have proved to be juvenile or atypical individuals of species already known from the Panamic region.

From the Atlantic cruises he lists 10 aspidochirotes, of which he considers seven common to both the Atlantic and the Pacific Oceans. His *Holothuria atra* from Florida proved, however, to be a dark-skinned *H. floridana* which had been preserved for a short time in formalin, causing the skin to be unusually smooth. His other species, except *H. arenicola* and *H. impatiens*, are considered distinct from those in the Panamic region.

of the Mexican coast to Isabel Island, designated as Mexico; and the northern part divided into the Gulf of California and the West coast of Lower California, including Guadalupe Island.

The species are arranged in the same order as they appear in this paper.

The region explored is a fairly natural province with the fauna most richly developed in the sheltered Gulf of California and in the Archipelago of the Galapagos Islands, and dropping off sharply southwards toward Peru and northward on the exposed western shore of Lower California.

Locality	Position	Station and date	Depth and bottom	Species collected
Galapagos Islands				
Albemarle Island				
Albemarle Point	0° 09′ 00″ N 91° 23′ 00″ W	69-33 Feb. 11, 1933	shore, rock, tide pools	*Isostichopus fuscus* *Brandtothuria impatiens* *Semperothuria imitans*
Albemarle Point	0° 09′ 00″ N 91° 23′ 00″ W	146-34 Jan. 12, 1934	shore, rock, tide pools	*Microthele difficilis* *Brandtothuria arenicola* *Brandtothuria gyrifer* *Lessonothuria pardalis* *Mertensiothuria leucospilota* *Ludwigothuria kefersteini* *Selenkothuria theeli*
Cartago Bay	0° 34′ 10″ S 90° 57′ 55″W	73-33 Feb. 13, 1933	shore, rock, sand, mangroves	*Microthele difficilis* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria kefersteini*
Cartago Bay	0° 34′ 10″ S 90° 57′ 55″W	76-33 Feb. 14, 1933	shore, sand	*Isostichopus fuscus* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria theeli*
Cartago Bay	0° 34′ 10″ S 90° 57′ 55″W	800-38 Jan. 22, 1938	north shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Lessonothuria pardalis* *Semperothuria imitans* *Ludwigothuria atra* *Ludwigothuria kefersteini* *Fossothuria rigida*
Cartago Bay	0° 34′ 10″ S 90° 57′ 55″W	188-34 Jan. 25, 1934	north shore, rock, sand	*Brandtothuria arenicola* *Lessonothuria pardalis* *Ludwigothuria atra* *Selenkothuria theeli*

East of south end	1° 04′ 00″ S 90° 39′ 00″ W	192-34 Jan. 27, 1934	120 fms rough rock	*Vaneyothuria zacae* f. *azacae*
Tagus Cove	0° 16′ 06″ S 91° 22′ 31″ W	150-34 Jan. 13, 1934	shore, rock	*Selenkothuria theeli*
Tagus Cove	0° 16′ 13″ S 91° 22′ 41″ W	9 Jan. 4-9, 1932	shore	*Selenkothuria theeli*
Tagus Cove	0° 16′ 16″ S 91° 22′ 39″ W	330-35 Dec. 10, 1934	12 fms, sand, nullipores	*Jaegerothuria inhabilis*
Between Albany and James Island	0° 10′ 45″ S 90° 52′ 08″ W	183-34 Jan. 24, 1934	50-70 fms rock, shell	*Vaneyothuria zacae* f. *azacae* *Jaegerothuria inhabilis*
Barrington Island	0° 51′ 35″ S 90° 02′ 00″ W	47-33 Feb. 2, 1933	2 fms	*Brandtothuria impatiens*
Barrington Island	0° 51′ 35″ S 90° 02′ 00″ W	48-33 Feb. 2, 1933	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria theeli*
Barrington Island	0° 51′ 35″ S 90° 02′ 00″ W	811-38 Jan. 26, 1938	shore, *Pocillopora* coral	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans*
Bartholomew Island, near James Island	0° 17′ 00″ S 90° 34′ 45″ W	179-34 Jan. 23, 1934	shore, lava rock	*Selenkothuria theeli*
Bartholomew Island, near James Island	0° 17′ 00″ S 90° 34′ 35″ W	244-35 Dec. 12, 1934	shallow water coral	*Ludwigothuria kefersteini*
Bindloe Island	0° 20′ 45″ N 90° 33′ 00″ W	306-35 Dec. 2, 1934	reef, lava rock	*Brandtothuria arenicola* *Selenkothuria theeli*
Charles Island				
Black Beach	1° 17′ 38″ S 90° 29′ 55″ W	166-34 Jan. 12, 1934	shore, rock	*Brandtothuria arenicola* *Semperothuria imitans* *Selenkothuria theeli*
Black Beach	1° 17′ 38″ S 90° 29′ 55″ W	199-34 Jan. 30, 1934	shore, rock	*Microthele difficilis* *Brandtothuria arenicola* *Brandtothuria impatiens*

Locality	Position	Station and date	Depth and bottom	Species collected
Black Beach	1° 17′ 38″ S 90° 29′ 55″ W	313-35 Dec. 6, 1934	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Ludwigothuria kefersteini* *Selenkothuria theeli* *Selenkothuria portovallartensis*
Black Beach	1° 16′ 36″ S 90° 29′ 52″ W	803-38 Jan. 23, 1938	shore, rock	*Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria theeli* *Selenkothuria portovallartensis*
South of Black Beach	1° 19′ 40″ S 90° 13′ 15″ W	351-35 Dec. 14, 1934	shore, turnable rocks	*Isostichopus fuscus* *Brandtothuria arenicola* *Semperothuria imitans* *Selenkothuria theeli*
Northwest of Post Office Bay	1° 09′ 40″ S 90° 33′ 00″ W	198-34 Jan. 29, 1934	55-65 fms sand	*Vaneyothuria zacae* f. *azacae*
Chatham Island				
Stephens Bay	0° 47′ 30″ S 89° 31′ 00″ W	170-34 Jan. 21, 1934	32 fms, fine sand, corallines	*Brandtothuria arenicola*
Wreck Bay	0° 53′ 55″ S 89° 36′ 35″ W	354-35 Dec. 15, 1934	shore, rock	*Selenkothuria theeli*
Duncan Island	0° 25′ 20″ S 90° 43′ 50″ W	80-33 Feb. 15, 1933	shallow water, coral	*Brandtothuria impatiens*
Hood Island				
Osborn Island, Gardner Bay	1° 22′ 52″ S 89° 39′ 15″ W	24-33 Jan. 24, 1933	shore, rock	*Labidodemas americanum* *Microthele difficilis* *Selenkothuria theeli*
Osborn Island, Gardner Bay	1° 22′ 52″ S 89° 39′ 15″ W	359-35 Dec. 19, 1934	shore, rock	*Labidodemas americanum* *Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria theeli*

Osborn Island, Gardner Bay	1° 22′ 52″ S 89° 39′ 15″ W	202-34 Jan. 31, 1934	shore, rock	*Brandtothuria impatiens* *Ludwigothuria kefersteini* *Selenkothuria theeli* *Selenkothuria portovallartensis*
Gardner Bay	1° 22′ 18″ S 89° 39′ 15″ W	357-35 Dec. 17, 1934	shallow water, coral	*Isostichopus fuscus* *Brandtothuria impatiens*
Gardner Bay	1° 22′ 30″ S 89° 40′ 23″ W	358-35 Dec. 17, 1934	shore, rock	*Brandtothuria arenicola* *Selenkothuria theeli*
Gardner Bay	1° 22′ 07″ S 89° 39′ 58″ W	362-35 Dec. 19, 1934	20 fms, rock, kelp, algae	*Isostichopus fuscus*
Off Gardner Bay	1° 21′ 55″ S 90° 40′ 05″ W	201-34 Jan. 31, 1934	25-35 fms, rock	*Vaneyothuria zacae* f. *azacae*
North of Hood Island	1° 21′ 55″ S 90° 40′ 05″ W	814-38 Jan. 28, 1938	20-40 fms, shell	*Vaneyothuria zacae* f. *azacae*
Indefatigable Island				
Academy Bay	0° 45′ 14″ S 90° 20′ 11″ W	168-34 Jan. 20, 1934	shore, rock	*Brandtothuria impatiens* *Ludwigothuria kefersteini* *Selenkothuria portovallartensis*
Academy Bay	0° 45′ 14″ S 90° 20′ 11″ W	314-35 Dec. 7, 1934	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria theeli* *Selenkothuria portovallartensis*
Conway Bay	0° 32′ 00″ S 90° 33′ 10″ W	11 Jan. 12-14, 1932	shore	*Brandtothuria impatiens* *Semperothuria imitans*
Conway Bay	0° 31′ 25″ S 90° 32′ 15″ W	82-33 Feb. 17, 1933	shore of small island, rock	*Selenkothuria theeli*
James Island				
James Bay	0° 12′ 02″ S 90° 52′ 08″ W	10 Jan. 9-12, 1932	shore	*Selenkothuria theeli*

Locality	Position	Station and date	Depth and bottom	Species collected
west coast of James Island	0° 16′ 10″ S 90° 53′ 45″ W	333-35 Dec. 10, 1934	shore, rocky ledges	*Isostichopus fuscus* *Brandtothuria arenicola* *Semperothuria imitans*
Sulivan Bay	0° 17′ 00″ S 90° 35′ 13″ W	343-35 Dec. 12, 1934	shore, rock	*Isostichopus fuscus* *Microthele difficilis* *Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria atra* *Selenkothuria theeli*
Sulivan Bay	0° 17′ 00″ S 90° 35′ 13″ W	796-38 Jan. 21, 1938	shore, rock	*Isostichopus fuscus* *Microthele difficilis* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria atra* *Selenkothuria portovallartensis* *Fossothuria rigida*
North Seymour Island	0° 23′ 15″ S 90° 19′ 25″ W	175-34 Jan. 22, 1934	shore, rock	*Brandtothuria arenicola* *Selenkothuria theeli*
South Seymour Island	0° 24′ 20″ S 90° 20′ 00″ W	174-34 Jan. 22, 1934	shore, rock, sand	*Ludwigothuria kefersteini*
South Seymour Island	0° 24′ 20″ S 90° 20′ 00″ W	789-38 Jan. 19, 1938	shore, rock, sand	*Isostichopus fuscus* *Brandtothuria arenicola* *Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria theeli*
South Seymour Island	0° 24′ 20″ S 90° 20′ 00″ W	793-38 Jan. 20, 1938	shore, rock, sand	*Selenkothuria theeli*
West of South Seymour Island	0° 24′ 20″ S 90° 20′ 00″ W	12 Jan. 14-18, 1932	shore	*Selenkothuria theeli*
Between South Seymour and Daphne Island	0° 24′ 25″ S 90° 21′ 50″ W	346-35 Dec. 13, 1934	55 fms mud, shell	*Vaneyothuria zacae* f. *azacae*

Tower Island				
Darwin Bay	0° 19′ 15″ N 89° 56′ 42″ W	13 Jan. 19-24, 1932	shore	*Lessonothuria pardalis* *Selenkothuria theeli*
Darwin Bay	0° 19′ 28″ N 89° 56′ 45″ W	93-33 Feb. 22, 1933	shore, lagoon, beach	*Lessonothuria pardalis* *Mertensiothuria leucospilota*
Darwin Bay	0° 19′ 18″ N 89° 57′ 14″ W	96-33 Feb. 24, 1933	shallow water, rock	*Brandtothuria impatiens* *Ludwigothuria kefersteini* *Selenkothuria theeli*
Darwin Bay	0° 19′ 18″ N 89° 57′ 14″ W	782-38 Jan. 16, 1938	shore, rocks	*Labidodemas americanum* *Microthele difficilis* *Ludwigothuria kefersteini* *Selenkothuria lubrica* *Selenkothuria theeli* *Selenkothuria portovallartensis*
Darwin Bay	0° 19′ 22″ N 89° 57′ 02″ W	784-38 Jan. 17, 1938	shore, rock	*Isostichopus fuscus* *Microthele difficilis* *Brandtothuria impatiens* *Ludwigothuria kefersteini*
Cocos Island, Costa Rica				
Chatham Bay	5° 32′ 56″ N 86° 59′ 18″ W	778-38 Jan. 14, 1938	shore, rocks	*Microthele difficilis* *Brandtothuria arenicola* *Brandtothuria impatiens* *Lessonothuria pardalis* *Semperothuria imitans* *Ludwigothuria atra* *Selenkothuria theeli*
Off Nuez Island	5° 34′ 00″ N 86° 59′ 20″ W	779-38 Jan. 14, 1938	30-50 fms, rock, coral, corallines	*Jaegerothuria inhabilis* *Theelothuria paraprinceps*
Clarion Island, Mexico				
Sulphur Bay	18° 20′ 05″ N 114° 44′ 40″ W	136-34 Jan. 5, 1934	32 fms nullipores	*Selenkothuria portovallartensis* *Theelothuria paraprinceps*
Sulphur Bay	18° 20′ 50″ N 114° 44′ 10″ W	141-34 Jan. 5, 1934	shore, shingle	*Brandtothuria arenicola* *Mertensiothuria leucospilota* *Ludwigothuria kefersteini*

Locality	Position	Station and date	Depth and bottom	Species collected
Sulphur Bay	18° 20′ 50″ N 114° 44′ 10″ W	298-34 Jan. 10, 1934	shore, rock, tide pools	*Microthele difficilis* *Brandtothuria arenicola* *Selenkothuria lubrica*
Sulphur Bay	18° 20′ 50″ N 114° 44′ 10″ W	916-39 Mar. 16, 1939	shore, shingle	*Microthele difficilis* *Semperothuria imitans* *Ludwigothuria kefersteini* *Theelothuria paraprinceps*
Sulphur Bay	18° 20′ 05″ N 114° 44′ 50″ W	917a-39 Mar. 16, 1939	28-35 fms sand, coralline	*Theelothuria paraprinceps*
North of Clarion Island	18° 23′ 45″ N 114° 44′ 50″ W	921c-39 Mar. 17, 1939	35-40 fms nullipores	*Theelothuria paraprinceps*
Socorro Island, Mexico				
Braithwaite Bay	18° 42′ 45″ N 110° 56′ 50″ W	128-34 Jan. 2, 1934	shore, rocks	*Ludwigothuria kefersteini* *Selenkothuria portovallartensis*
Braithwaite Bay	18° 42′ 45″ N 110° 56′ 50″ W	130-34 Jan. 3, 1934	shore, rocks, large shingle, tide pools	*Brandtothuria arenicola* *Selenkothuria portovallartensis*
East of Cape Rule	18° 42′ 25″ N 110° 57′ 40″ W	297-34 June 9, 1934	diving and netting	*Isostichopus fuscus* *Mertensiothuria leucospilota* *Ludwigothuria kefersteini*
Peru				
SW of Zorritos Light	3° 45′ 50″ S 79° 47′ 00″ W	847-38 Feb. 16, 1938	shore, rocks	*Ludwigothuria kefersteini* *Selenkothuria portovallartensis*
Ecuador				
Point Brava, Santa Elena Bay	2° 12′ 23″ S 81° 00′ 05″ W	19-33 Jan. 21, 1933	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
S of Santa Elena Point	2° 12′ 23″ S 81° 00′ 05″ W	207-34 Feb. 8, 1934	shore, rocks	*Ludwigothuria kefersteini* *Selenkothuria lubrica* *Selenkothuria theeli*

S of Santa Elena Point	2° 12′ 00″ S 81° 00′ 25″ W	10-33 Jan. 18, 1933	shore, rocks	*Selenkothuria lubrica*
Off Santa Elena Bay	2° 08′ 20″ S 81° 00′ 15″ W	209-34 Feb. 9, 1934	8-10 fms, rocks, large shells	*Jaegerothuria inhabilis*
La Plata Island	1° 16′ 00″ S 81° 05′ 10″ W	22-33 Jan. 22, 1933	shore	*Selenkothuria lubrica*
Off La Plata Island	1° 15′ 00″ S 81° 04′ 15″ W	212-34 Feb. 10, 1934	45-55 fms rock, mud	*Vaneyothuria zacae* f. *typica*
W of Manta	0° 56′ 43″ S 80° 44′ 43″ W	403-35 Jan. 20, 1935	reef with breakers	*Brandtothuria arenicola* *Ludwigothuria kefersteini*
Manta Bay	0° 56′ 30″ S 80° 44′ 18″ W	400-35 Jan. 19, 1935	shore, rock, sand	*Brandtothuria arenicola* *Selenkothuria portovallartensis*
Cape San Francisco	0° 39′ 30″ N 80° 06′ 30″ W	848-38 Feb. 23, 1938	shore, rock	*Selenkothuria lubrica*
Colombia				
Gorgona Island	2° 58′ 00″ N 78° 11′ 30″ W	405-35 Jan. 22, 1935	shore, rock, sand	*Brandtothuria arenicola* *Lessonothuria pardalis* *Selenkothuria lubrica*
Gorgona Island	2° 58′ 00″ N 78° 11′ 50″ W	411-35 Jan. 22, 1935	shallow water, coral (Pocillopora)	*Brandtothuria impatiens*
Gorgona Island	3° 00′ 30″ N 78° 11′ 45″ W	853-38 Feb. 24, 1938	shore, rock	*Selenkothuria lubrica*
Cabita Bay, Cape Corrientes	5° 29′ 20″ N 77° 29′ 35″ W	229-34 Feb. 13, 1934	shore near stream, sand	*Selenkothuria lubrica*
Port Utria	5° 59′ 10″ N 77° 21′ 20″ W	413-35 Jan. 23, 1935	shore, rock	*Brandtothuria arenicola* *Selenkothuria lubrica*
Port Utria	5° 59′ 10″ N 77° 20′ 20″ W	232-34 Feb. 14, 1934	shore, rock	*Brandtothuria arenicola* *Brandtothuria gyrifer* *Irenothuria maccullochi* *Selenkothuria lubrica*
Port Utria	5° 59′ 10″ N 77° 21′ 00″ W	856-38 Feb. 25, 1938	15-30 fms mud, sand	*Selenkothuria lubrica*

Locality	Position	Station and date	Depth and bottom	Species collected
Port Utria	5° 59′ 10″ N 77° 21′ 20″ W	858-38 Feb. 25, 1938	shore, rock	*Selenkothuria lubrica*
Port Utria	5° 59′ 10″ N 77° 21′ 20″ W	859-38 Feb. 25, 1938	shallow water, coral	*Brandtothuria impatiens*
off Port Utria	5° 59′ 25″ N 77° 21′ 50″ W	238-34 Feb. 15, 1934	20 fms, sand, shell, cake urchins	*Brandtothuria impatiens*
Port Utria	5° 59′ 40″ N 77° 21′ 30″ W	239-34 Feb. 15, 1934	shore, reef inside outer island	*Brandtothuria arenicola* *Brandtothuria impatiens* *Brandtothuria gyrifer*
Port Utria	5° 59′ 55″ N 77° 20′ 30″ W	418-35 Jan. 24, 1935	shore, sand	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Cupica Bay	6° 39′ 10″ N 77° 30′ 40″ W	427-35 Jan. 26, 1935	shore, rock	*Selenkothuria lubrica*
Octavia Bay	6° 49′ 50″ N 77° 41′ 50″ W	433-35 Jan. 27, 1935	shore on island, shingle	*Brandtothuria arenicola* *Irenothuria maccullochi* *Selenkothuria lubrica* *Selenkothuria portovallartensis*
Octavia Bay	6° 50′ 00″ N 77° 41′ 10″ W	435-35 Jan. 28, 1935	shallow water, coral	*Brandtothuria impatiens*
Panama				
Bahia Honda	7° 43′ 15″ N 81° 32′ 40″ W	246-34 Feb. 21, 1934	rocky reef	*Selenkothuria lubrica*
Bahia Honda	7° 44′ 25″ N 81° 32′ 45″ W	861-38 Mar. 1, 1938	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Semperothuria languens* *Irenothuria maccullochi* *Selenkothuria lubrica* *Fossothuria rigida*

Bahia Honda	7° 45′ 00″ N 81° 31′ 40″ W	947-39 Mar. 28, 1939	shore, sand, rock	*Semperothuria languens*
Secas Islands	7° 57′ 00″ N 82° 01′ 25″ W	446b-35 Feb. 4, 1935	shore, rock	*Lessonothuria pardalis* *Fossothuria rigida* f. *atypica*
Secas Islands	7° 57′ 10″ N 82° 00′ 45″ W	447-35 Feb. 4, 1935	shallow water, coral	*Microthele difficilis* *Brandtothuria impatiens* *Semperothuria imitans*
Secas Islands	7° 57′ 10″ N 82° 00′ 45″ W	454-35 Feb. 6, 1935	shore, tide flats, coral	*Microthele difficilis* *Brandtothuria impatiens* *Lessonothuria pardalis*
Secas Islands	7° 57′ 10″ N 82° 00′ 45″ W	867-38 Mar. 2, 1938	shallow water, coral	*Microthele difficilis* *Brandtothuria impatiens* *Lessonothuria pardalis* *Semperothuria imitans* *Ludwigothuria kefersteini*
Taboga Island	8° 47′ 35″ N 79° 33′ 15″ W	957-39 May 2, 1939	shore, rock, tide pools	*Semperothuria languens*
Panama City	8° 57′ 15″ N 79° 31′ 45″ W	445-35 Feb. 2, 1935	shore, rock	*Semperothuria languens* *Ludwigothuria kefersteini* *Selenkothuria lubrica*
Costa Rica				
Near South Viradores Islands, Port Culebra	10° 34′ 30″ N 85° 42′ 50″ W	258-34 Feb. 25, 1934	shallow water, coral	*Brandtothuria impatiens*
Off South Viradores Islands, Port Culebra	10° 35′ 00″ N 85° 45′ 15″ W	257-34 Feb. 25, 1934	10 fms, sand, shells	*Microthele difficilis*
S of Mala Point, Port Culebra	10° 36′ 30″ N 85° 42′ 15″ W	256-34 Feb. 24, 1934	shore, rock	*Microthele difficilis* *Brandtothuria impatiens* *Irenothuria maccullochi* *Selenkothuria lubrica*
Port Parker	10° 54′ 55″ N 85° 49′ 00″ W	473-35 Feb. 9, 1935	shallow water, coral	*Brandtothuria impatiens*
Port Parker	10° 56′ 00″ N 85° 48′ 47″ W	466-35 Feb. 9, 1935	shore, small island at entrance, rock	*Brandtothuria arenicola* *Selenkothuria lubrica*

Locality	Position	Station and date	Depth and bottom	Species collected
Playa Blanca	10° 56′ 45″ N 85° 53′ 30″ W	465-35 Feb. 8, 1935	shore, shale	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria languens* *Ludwigothuria kefersteini* *Fossothuria rigida* f. *atypica*
Salinas Bay	11° 02′ 00″ N 85° 42′ 45″ W	474-35 Feb. 10, 1935	shore, sandstone	*Selenkothuria lubrica* *Selenkothuria portovallartensis*
Mexico				
Tangola Tangola Bay	15° 45′ 37″ N 96° 05′ 24″ W	260-34 Mar. 1, 1934	shore on small island in bay, rock	*Brandtothuria gyrifer* *Selenkothuria lubrica*
Tangola Tangola Bay	15° 45′ 37″ N 96° 05′ 24″ W	261-34 Mar. 1, 1934	shallow water, coral	*Selenkothuria lubrica* *Selenkothuria portovallartensis*
Roqueta or Grifo Island, off Acapulco Harbor		1548-46 Sept. 1, 1946	north shore	*Ludwigothuria kefersteini*
Roqueta or Grifo Island, off Acapulco Harbor	16° 49′ 19″ N 99° 00′ 30″ W	2592-54 Jan. 30, 1954	0-1 fms, sand, rock	*Ludwigothuria kefersteini* *Semperothuria imitans*
Santa Lucia Bay, Acapulco		1561-46 Sept. 13, 1946		*Brandtothuria impatiens*
Santa Lucia Bay, Acapulco	16° 50′ 54″ N 99° 55′ 18″ W	2596-54 Feb. 1-2, 1954	1-4 fms, rock, mud, sand	*Brandtothuria impatiens* *Brandtothuria gyrifer*
Petatlan Bay	17° 31′ 30″ N 101° 27′ 15″ W	270-34 Mar. 3, 1934	shore, rock	*Selenkothuria lubrica*
S of islands off Navidad Head, Tenacatita	19° 12′ 50″ N 104° 50′ 50″ W	274-34 Mar. 4, 1934	50 fms mud, sand	*Lessonothuria pardalis* *Semperothuria languens*
Tenacatita Bay	19° 17′ 55″ N 104° 49′ 30″ W	2-33 Jan. 3, 1933	shore	*Semperothuria languens* *Selenkothuria lubrica*
Cleopha Island, Tres Marias Islands	21° 17′ 38″ N 106° 15′ 10″ W	2601-54 Feb. 7, 1954	shore of lagoon, loose rock, sand	*Microthele difficilis* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Mertensiothuria leucospilota* *Semperothuria languens* *Selenkothuria lubrica*

Magdalena Island, Tres Marias Islands	21° 26′ 00″ N 106° 23′ 20″ W	972-39 May 9, 1939	shore, rock	*Isostichopus fuscus* *Brandtothuria arenicola* *Brandtothuria gyrifer* *Semperothuria languens* *Selenkothuria lubrica*
Isabel Island	21° 51′ 30″ N 105° 33′ 35″ W	749-37 Apr. 3, 1937	rocky reef, low tide	*Selenkothuria lubrica*
Isabel Island	21° 51′ 30″ N 105° 53′ 35″ W	278-34 Mar. 5, 1934	shore in cove, sand, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Semperothuria imitans* *Selenkothuria lubrica*
Isabel Island	21° 52′ 20″ N 105° 53′ 40″ W	2588-54 Jan. 26, 1954	0-3 fms, rock	*Isostichopus fuscus* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Ludwigothuria kefersteini* *Selenkothuria lubrica*
Isabel Island	21° 54′ 10″ N 105° 58′ 15″ W	870-38 Mar. 8, 1938	10-15 fms, coralline, gorgonids	*Ludwigothuria kefersteini* *Selenkothuria lubrica*
Gulf of California				
NE of Cape San Lucas	22° 53′ 14″ N 109° 51′ 50″ W	1724-49 Mar. 11, 1949	10 fms, sand, shell	*Brandtothuria arenicola* *Semperothuria languens* *Ludwigothuria kefersteini* *Selenkothuria portovallartensis* *Fossothuria rigida* f. *atypica* *Theelothuria paraprinceps*
Cabeza Ballena	22° 53′ 20″ N 109° 50′ 20″ W	623-37 Mar. 4, 1937	shore, rock, tide pools	*Selenkothuria lubrica*
NE of Cabeza Ballena	22° 54′ 23″ N 109° 50′ 09″ W	1727-49 Mar. 11, 1949	shore, granitic reef	*Microthele difficilis* *Brandtothuria impatiens* *Brandtothuria gyrifer* *Selenkothuria lubrica*
N of Palmilla Point	23° 00′ 30″ N 109° 42′ 55″ W	1730-49 Mar. 12, 1949	shore, sand	*Ludwigothuria kefersteini*

Locality	Position	Station and date	Depth and bottom	Species collected
Los Frailes Bay	23° 22′ 45″ N 109° 24′ 37″ W	1734-49 Mar. 13, 1949	shore, rocky beach, tide pools	*Microthele difficilis* *Brandtothuria impatiens* *Semperothuria languens*
Boco de la Trinidad	23° 38′ 00″ N 109° 28′ 22″ W	1037-40 Jan. 21, 1940	150 fms, sand, coralline	*Vaneyothuria zacae*
San Lorenzo Channel	24° 21′ 55″ N 110° 18′ 40″ W	639-37 Mar. 7, 1937	3-5 fms, sand, coralline, algae	*Mertensiothuria fuscocinerea*
San Lorenzo Channel	24° 21′ 55″ N 110° 15′ 15″ W	1111-40 Feb. 14, 1940	6-13 fms, sand, shell, coralline	*Mertensiothuria fuscocinerea*
Espiritu Santo Island	24° 25′ 15″ N 110° 21′ 10″ W	20 Feb. 17-20, 1932	shore	*Mertensiothuria fuscocinerea*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	604-36 Mar. 20, 1936	shallow water, coral	*Brandtothuria arenicola* *Semperothuria imitans*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	500-36 Feb. 20, 1936	shore, sand, rock	*Selenkothuria lubrica*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	501-36 Feb. 20, 1936	shallow water, coral	*Microthele difficilis* *Brandtothuria impatiens* *Semperothuria imitans*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	634-37 Mar. 6, 1937	shallow water, coral	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	638-37 Mar. 7, 1937	shallow water, coral	*Brandtothuria arenicola* *Brandtothuria impatiens* *Mertensiothuria fuscocinerea* *Fossothuria rigida* f. *atypica*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	1108-40 Feb. 13, 1940	shore, shingle	*Brandtothuria arenicola* *Brandtothuria impatiens* *Mertensiothuria fuscocinerea* *Semperothuria imitans* *Selenkothuria lubrica*

San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	1109-40 Feb. 14, 1940	½-2 fms dipnetting	*Mertensiothuria fuscocinerea* *Ludwigothuria kefersteini*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	1110-40 Feb. 14, 1940	shoal, coral	*Microthele difficilis* *Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
San Gabriel Bay, Espiritu Santo Island	24° 25′ 25″ N 110° 20′ 55″ W	1112-40 Feb. 14, 1940	shore, shingle, tide pools at stone pits	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
Cove S of Ballenas Bay, Espiritu Santo Island	24° 26′ 35″ N 110° 22′ 00″ W	510-36 Feb. 22, 1936	shore, sand, rocks	*Isostichopus fuscus* *Brandtothuria arenicola* *Brandtothuria impatiens* *Irenothuria maccullochi* *Selenkothuria lubrica*
Ballenas Bay, Espiritu Santo Island	24° 27′ 45″ N 110° 22′ 00″ W	512-36 Feb. 23, 1936	shore, rocks	*Isostichopus fuscus* *Labidodemas americanum* *Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
E of San Francisco Island	24° 49′ 50″ N 110° 34′ 00″ W	515-36 Feb. 24, 1936	shore, reef	*Selenkothuria lubrica*
San Francisco Island	24° 49′ 50″ N 110° 34′ 00″ W	646-37 Mar. 8, 1937	shore, shingle	*Brandtothuria impatiens* *Semperothuria imitans*
San Francisco Island	24° 49′ 50″ N 110° 34′ 00″ W	652-37 Mar. 9, 1937	shore, shingle	*Brandtothuria arenicola* *Brandtothuria impatiens*
Agua Verde Bay	25° 29′ 40″ N 110° 58′ 45″ W	522-36 Feb. 27, 1936	shore, reef	*Brandtothuria impatiens* *Selenkothuria lubrica*
Agua Verde Bay	25° 29′ 40″ N 110° 58′ 45″ W	664-37 Mar. 11, 1937	low tide, San Marcial Reef	*Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
Agua Verde Bay	25° 30′ 45″ N 111° 04′ 11″ W	1744-49 Mar. 17, 1949	shore, rocky beach	*Brandtothuria impatiens* *Selenkothuria lubrica*

Locality	Position	Station and date	Depth and bottom	Species collected
Agua Verde Bay	25° 31′ 05″ N 111° 02′ 30″ W	660-37 Mar. 10, 1937	shore, north cove, rock	*Isostichopus fuscus*
Agua Verde Bay	25° 31′ 05″ N 111° 02′ 30″ W	1104-40 Feb. 12, 1940	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Puerto Escondido	25° 48′ 45″ N 111° 18′ 51″ W	1752-49 Mar. 20, 1949	shore, rocky beach	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
Puerto Escondido	25° 48′ 04″ N 111° 18′ 53″ W	1749-49 Mar. 18, 1949	rocky shore	*Brandtothuria impatiens* *Brandtothuria gyrifer* *Semperothuria imitans* *Selenkothuria lubrica*
Puerto Escondido	25° 48′ 47″ N 111° 18′ 51″ W	1774-49 Mar. 28, 1949	shore, rocky beach	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Puerto Escondido	25° 49′ 25″ N 111° 18′ 35″ W	1093-40 Feb. 10, 1940	8-15 fms, sand, sponge, coral	*Mertensiothuria fuscocinerea*
Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	670-37 Mar. 12, 1937	Shore, lagoon entrance, mud	*Brandtothuria arenicola*
Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	591-36 Mar. 16, 1936	shore, shingle	*Isostichopus fuscus* *Brandtothuria impatiens* *Semperothuria imitans* *Ludwigothuria kefersteini* *Selenkothuria lubrica*
Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	1094-40 Feb. 10, 1940	shore, mouth of lagoon, rock	*Brandtothuria impatiens* *Selenkothuria lubrica*
Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	1095-40 Feb. 11, 1940	1-2 fms dipnetting	*Mertensiothuria fuscocinerea*
Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	598-36 Mar. 17, 1936	dipnet and beach	*Mertensiothuria fuscocinerea*

Puerto Escondido	25° 50′ 05″ N 111° 19′ 00″ W	670-37 Mar. 12, 1937	shore, lagoon entrance	*Brandtothuria arenicola* *Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
Perico Point, Carmen Island	25° 57′ 48″ N 111° 05′ 09″ W	1757-49 Mar. 21, 1949	shore, rocky beach	*Brandtothuria arenicola* *Selenkothuria lubrica* *Fossothuria rigida* f. *atypica*
W side of Bargo Island	26° 42′ 17″ N 111° 53′ 33″ W	1772-49 Mar. 27, 1949	shore, rocky beach	*Brandtothuria arenicola* *Selenkothuria lubrica*
Coyote Bay, Concepcion Bay	26° 44′ 40″ N 111° 54′ 00″ W	689-37 Mar. 16, 1937	shore, sand, rock	*Selenkothuria lubrica* *Theelothuria paraprinceps*
Aguja Point, Concepcion Bay	26° 51′ 30″ N 111° 52′ 08″ W	1769-49 Mar. 26, 1949	shore, tide pools	*Isostichopus fuscus* *Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
N of Cabo Arco, Ensenada Carrizal		1513-46 May 15, 1946	shore, reef	*Isostichopus fuscus*
Bahia Catalina, off Guaymas, Sonora	27° 51′ 50″ N 111° 06′ 15″ W	1092-40 Feb. 9, 1940	shore, shingle	*Isostichopus fuscus* *Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Guaymas Bay, Sonora	27° 54′ 28″ N 110° 54′ 18″ W	1041-40 Jan. 23, 1940	shore, shingle	*Brandtothuria impatiens* *Selenkothuria lubrica* *Fossothuria rigida*
Ensenada Bocochibampo, Guaymas	27° 55′ 08″ N 110° 50′ 43″ W	1514-46 May 16, 1946	rocky shore	*Selenkothuria lubrica*
Ensenada Bocochibampo, Guaymas		1515-46 May 16, 1946	mud flats, sandy estuary	*Selenkothuria lubrica*
Ensenada de San Francisco, Guaymas		1516-46 May 17, 1946	reefs, pools	*Selenkothuria lubrica*
Ensenada de San Francisco, Guaymas	27° 55′ 08″ N 110° 50′ 50″ W	1517-46 May 18, 1946	reefs, pools	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*

Locality	Position	Station and date	Depth and bottom	Species collected
Vicinity of Puerto San Carlos, Guaymas	27° 56′ 00″ N 111° 05′ 12″ W	1767-49 Mar. 24, 1949	shore, rocky beach	*Brandtothuria impatiens* *Semperothuria imitans* *Selenkothuria lubrica*
Puerto San Carlos, Guaymas	27° 56′ 52″ N 111° 05′ 11″ W	1766-49 Mar. 24, 1949	shore	*Brandtothuria impatiens*
Vicinity of Puerto San Carlos, Guaymas	27° 57′ 00″ N 111° 04′ 00″ W	1765-49 Mar. 24, 1949	1 fm	*Brandtothuria impatiens*
Ensenada de San Francisco, Guaymas	27° 57′ 05″ N 111° 03′ 20″ W	739-37 Mar. 30, 1937	shore, shingle	*Selenkothuria lubrica* *Selenkothuria theeli*
Puerto San Carlos, Guaymas	27° 57′ 15″ N 111° 04′ 45″ W	1091-40 Feb. 8, 1940	shore, shingle	*Isostichopus fuscus* *Brandtothuria impatiens* *Selenkothuria lubrica* *Fossothuria rigida*
San Pedro Nolasco Island	27° 58′ 35″ N 111° 22′ 40″ W	1084-40 Feb. 6, 1940	93-111 fms, rocks	*Jaegerothuria inhabilis*
N of San Pedro Nolasco Island	27° 58′ 40″ N 111° 24′ 10″ W	573-36 Mar. 12, 1936	60 fms rock, sand	*Vaneyothuria zacae* f. *typica*
San Francisquito Bay	28° 26′ 40″ N 112° 52′ 40″ W	533-35 Mar. 2, 1936	40 fms, sand, broken shell	*Vaneyothuria zacae* f. *typica*
San Esteban Island	28° 39′ 40″ N 112° 35′ 35″ W	1083-40 Feb. 5, 1940	shore, rock	*Brandtothuria impatiens* *Selenkothuria lubrica*
S shore of Tiburon Island	28° 45′ 35″ N 112° 17′ 45″ W	1045-40 Jan. 25, 1940	shore, shingle	*Isostichopus fuscus* *Brandtothuria impatiens* *Selenkothuria lubrica*
S of Isla Partida	28° 51′ 20″ N 113° 03′ 45″ W	559-36 Mar. 9, 1936	45 fms, sand	*Jaegerothuria inhabilis*
Angeles Bay	28° 53′ 40″ N 113° 32′ 45″ W	537-36 Mar. 2, 1936	shore, sand	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Angeles Bay	28° 53′ 40″ N 113° 32′ 45″ W	700-37 Mar. 19, 1937	shore, shingle	*Brandtothuria impatiens* *Selenkothuria lubrica*

Between Isla Partida and Angel de la Guarda Island	28° 56′ 50″ N 113° 07′ 00″ W	555-36 Mar. 8, 1936	20 fms, nullipores	*Jaegerothuria inhabilis*
Entrance to Angeles Bay	28° 57′ 00″ N 113° 30′ 45″ W	535-36 Mar. 2, 1936	25-40 fms, sand	*Vaneyothuria zacae* f. *typica*
Entrance to Angeles Bay	28° 57′ 00″ N 113° 30′ 45″ W	538-36 Mar. 3, 1936	25 fms, sand	*Vaneyothuria zacae* f. *typica*
Angeles Channel	28° 57′ 35″ N 113° 29′ 30″ W	699-37 Mar. 19, 1937	30 fms, sand	*Vaneyothuria zacae* f. *typica*
E of Angel de la Guarda Island	29° 01′ 00″ N 113° 12′ 15″ W	554-36 Mar. 8, 1936	10 fms, sand, red algae, scallops	*Vaneyothuria zacae* f. *typica*
Pond Island, Angel de la Guarda Island	29° 02′ 35″ N 113° 07′ 40″ W	1079-40 Feb. 4, 1940	shore, rocks	*Brandtothuria arenicola* *Brandtothuria impatiens*
Puerto Refugio, Angel de la Guarda Island	29° 32′ 07″ N 113° 34′ 12″ W	545-36 Mar. 4, 1936	shore, rocks	*Vaneyothuria zacae* f. *typica* (beachworn)
Puerto Refugio, Angel de la Guarda Island	29° 32′ 47″ N 113° 34′ 47″ W	707-37 Mar. 20, 1937	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Puerto Refugio, Angel de la Guarda Island	29° 32′ 47″ N 113° 34′ 35″ W	713-37 Mar. 21, 1937	shore, rock	*Selenkothuria lubrica*
Puerto Refugio, Angel de la Guarda Island	29° 32′ 47″ N 113° 34′ 35″ W	1049-40 Jan. 27, 1940	shore, rocky reef	*Brandtothuria impatiens* *Selenkothuria lubrica*
Puerto Refugio, Angel de la Guarda Island	29° 32′ 47″ N 113° 34′ 35″ W	1053-40 Jan. 28, 1940	shore, rock	*Brandtothuria arenicola* *Brandtothuria impatiens*
Puerto Refugio, Angel de la Guarda Island	29° 33′ 45″ N 113° 32′ 24″ W	711-37 Mar. 21, 1937	40 fms, sand	*Jaegerothuria inhabilis* *Vaneyothuria zacae* f. *typica*
Off Puerto Refugio	29° 33′ 45″ N 113° 30′ 32″ W	1057-40 Jan. 29, 1940	51-56 fms sandy gravel	*Vaneyothuria zacae* f. *typica*
Puerto Refugio, Angel de la Guarda Island	29° 34′ 25″ N 113° 32′ 35″ W	708-37 Mar. 21, 1937	60 fms, sand	*Vaneyothuria zacae* f. *typica*
Puerto Refugio, Angel de la Guarda Island	29° 34′ 25″ N 113° 32′ 35″ W	541-36 Mar. 4, 1936	60 fms broken shell	*Vaneyothuria zacae* f. *typica*

Locality	Position	Station and date	Depth and bottom	Species collected
Puerto Refugio, Angel de la Guarda Island	29° 34′ 35″ N 113° 29′ 30″ W	712-37 Mar. 21, 1937	50-75 fms, sand	*Vaneyothuria zacae* f. *typica*
N of Granite Island, Angel de la Guarda Island	29° 34′ 50″ N 113° 33′ 45″ W	1055-40 Jan. 28, 1940	57 fms, shells, cake urchins	*Vaneyothuria zacae* f. *typica*
Willard Island, Gonzaga Bay	29° 48′ 25″ N 114° 23′ 30″ W	1063-40 Jan. 30, 1940	shore, shingle	*Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Tepoca Bay	30° 15′ 45″ N 112° 53′ 20″ W	1076-40 Feb. 3, 1940	shore, rock, reef	*Selenkothuria lubrica*
Tepoca Bay	30° 15′ 45″ N 112° 53′ 20″ W	1077-40 Feb. 4, 1940	shore, rock, reef	*Isostichopus fuscus* *Brandtothuria arenicola* *Brandtothuria impatiens* *Selenkothuria lubrica*
Georges Island	31° 00′ 40″ N 113° 16′ 05″ W	723-37 Mar. 25, 1937	shore, rock	*Selenkothuria lubrica*
West coast of Lower California				
E shore of Santa Margarita Island	24° 29′ 24″ N 111° 50′ 26″ W	1719-49 Mar. 9, 1949	shore, sand and rock	*Fossothuria rigida*
Entrada Point, Magdalena Bay	24° 30′ 30″ N 112° 00′ 51″ W	1713-49 Mar. 8, 1949	shore, rocky beach	*Brandtothuria impatiens* *Selenkothuria lubrica*
San Juanico Bay, inside Punta Pequeña	26° 15′ 00″ N 112° 28′ 45″ W	1960-50 May 1, 1950	shore, rock	*Selenkothuria lubrica*
Guadalupe Island	27° 06′ 00″ N 118° 15′ 00″ W	758-37 July 18, 1937	shore, elephant seal beach	*Vaneyothuria zacae* f. *iota*
W of Malarrimo Point	27° 49′ 00″ N 114° 43′ 00″ W	2022-51 Apr. 17, 1951	shore, rock, reef, tide pools	*Brandtothuria impatiens*
W of Malarrimo Point	27° 49′ 00″ N 114° 43′ 00″ W	2025-51 Apr. 18, 1951	shore, reef, tide pools	*Brandtothuria impatiens*

Nameless Cove, E of Punta Eugenia	27° 50′ 00″ N 114° 51′ 30″ W	2064-51 Oct. 31, 1951	shore, rock, shingle	*Brandtothuria impatiens* *Selenkothuria lubrica*
Lagoon Head Anchorage	28° 12′ 25″ N 114° 06′ 30″ W	612-37 Mar. 1, 1937	7 fms, sand	*Isostichopus fuscus*
Cove S of Cedros Island Light	28° 20′ 56″ N 115° 11′ 23″ W	1696-49 Mar. 4, 1949	10-20 fms, sand, broken shell	*Vaneyothuria zacae* f. *iota*
Melpomene Cove, Guadalupe	28° 51′ 03″ N 118° 17′ 43″ W	1920-49 Dec. 19, 1949	50-51 fms, sand	*Vaneyothuria zacae* f. *iota*
Melpomene Cove, Guadalupe	28° 55′ 33″ N 118° 18′ 38″ W	1919-49 Dec. 19, 1949	34-36 fms, sand	*Vaneyothuria zacae* f. *iota*
Off Rosario Bay	29° 53′ 45″ N 115° 49′ 30″ W	611-37 Feb. 28, 1937	25 fms, rock	*Brandtothuria impatiens*

Systematic Arrangement

I had hoped to include a complete revision of all the tropical shallow water aspidochirotes, of which the Museum of Comparative Zoology possesses an unequalled series, but this was not found practical. Like every worker who studies these forms, I am greatly indebted to Panning's revision of the genus *Holothuria*. But this magnificent work suffers from his dependence in too many cases on the accounts of earlier writers; hence many errors have been perpetuated and related forms have been placed far apart. I would have preferred to follow his arrangement, but this has not always been possible. Where his groups have been well defined, as in his concept of Brandt's *Microthele*, I have used them. In other cases, as in his use of the name *Sporadipus*, I have had to take another course, and the best solution seemed to be to split up the old genus *Holothuria* into a series of new genera. As far as possible I have used the old ending *-othuria* with a suitable prefix, resulting in names like *Selenkothuria*, *Theelothuria*, *Mertensiothuria*, etc., which should not be too difficult to apply.

Many attempts have been made to arrange the numerous species in the old genus *Holothuria* in a reasonable systematic order, and the key which is given here for the genera known from the Panamic region should make it clear how the lines have been drawn.

The members of this group are essentially adapted to live either free on the bottom of lagoons, or buried in sand or mud, or clinging to rocks, often exposed to the surf. Within each habitat are groups in different stages of development, which can be separated by means of their spicules. Most primitive are undoubtedly those with numerous regular tables and regular smooth buttons, somewhat reminiscent of certain synallactidlike members of the Stichopodidae. A more advanced stage is indicated by the presence of irregular buttons, or the development of rosettes, or the reduction of the inner layer of spicules, while the tables have become variously modified. In the surf-loving forms, one group has a well developed layer of tables, another section has them reduced almost completely, and in some species there are only a few rods in the inner layer. Among the burrowing forms, some are more or less cylindrical in body form while others are flattened, and the spicules vary from regular tables and buttons, to hemispherical tables and regularly knobbed buttons, to reduced tables and irregularly knobbed, deformed buttons, etc. There is nothing essentially new in the present arrange-

ment and much of what is presented here is more or less foreshadowed in the key which W. K. Fisher made for the Hawaiian holothurians in 1907.

Affinities to Other Regions

The aspidochirote shallow water forms may be grouped roughly as follows: Two species are almost circumtropical, *Brandtothuria arenicola* and *B. impatiens*, while six appear to be offshoots from the west Pacific and from their sparse occurrence may be considered more or less casual visitors in the Panamic region: *Ludwigothuria atra*, *Mertensiothuria fuscocinerea*, *Brandtothuria gyrifer*, *Semperothuria imitans*, *Mertensiothuria leucospilota*, and *Lessonothuria pardalis*. Four species are closely related to West Indian forms and apparently do not occur outside the Panamic region: *Isostichopus fuscus, Ludwigothuria kefersteini, Semperothuria languens*, and *Selenkothuria lubrica*, with the corresponding forms in the West Indies: *Isostichopus badionotus*, *Ludwigothuria grisea*, *Semperothuria surinamensis*, and *Selenkothuria glaberrima*.

Another group is widespread in the Indo-West Pacific region and has more or less closely related counterparts in the West Indies: *Microthele difficilis*, *Jaegerothuria inhabilis*, *Theelothuria paraprinceps*, *Fossothuria rigida*, and *Vaneyothuria zacae*, with the corresponding West Indian forms *Microthele parvula, Jaegerothuria occidentalis, Theelothuria princeps, Fossothuria cubana*, and *Vaneyothuria lentiginosa. Theelothuria paraprinceps* in all probability will be found to be identical with some older species from the East Indies, while *Vaneyothuria zacae* may be withdrawn as a synonym of some such form as *V. integra* or *V. neozelanica.*

Apparently endemic to the Panamic region are *Labidodemas americanum*, *Irenothuria maccullochi, Selenkothuria portovallartensis*, and *S. theeli*, to which it seems proper to add *Mertensiothuria platei*, from Juan Fernandez, as it may possibly extend into the southernmost part of the Panamic region and is not known from outside the American waters.

Aside from *Isostichopus*, the total absence of such large lagoon forms as the members of the genera *Actinopyga*, *Bohadschia*, *Astichopus*, etc., is noteworthy.

Compared with Hawaii and the West Indies, using Fisher's and Deichmann's papers, the supposedly barren shores of the Panamic region have more aspidochirote forms than either. About one third of the fauna

consists of species which have been able to cross Ekman's "barrier," another third is most closely related to the West Indian fauna, and the rest are either endemic or closely related to widespread Indo-Pacific forms. Future explorations may modify these statements somewhat. More species may be found in Hawaii, as well as in the Gulf of Mexico; some of the species described as special to Hawaii may be withdrawn as synonyms, etc.; but as a whole the present picture will not be altered much and there seems no great likelihood that many more species will be added to the Panamic fauna.

ASPIDOCHIROTA

(from shallow water)

Key to the families of shallow water Aspidochirota

Gonads in two tufts. Large forms, often with thickened flanks, cylindrical feet in crowded bands on the ventrum, and large warts on the dorsum. Spicules a crowded to reduced layer of tables and often delicate, C-shaped bodies, or as minute grains. Smooth buttons in some genera. I. Stichopodidae

Gonads in single tuft. Small to large forms; flanks not thickened. Spicules variously developed, never as delicate, C-shaped bodies. II. Holothuriidae

I. Stichopodidae

Diagnosis: Large primitive aspidochirotes, with gonads in two tufts, tentacle ampillae, and well developed respiratory trees. Exterior more or less synallactidlike. Except for one doubtful genus (*Astichopus*), ventral feet large, in more or less crowded bands, dorsal side with papillae, simple or complex, few to many. Large ventral tentacles and terminal anus. Spicules in most genera tables, and in addition either smooth buttons, regular or deformed, delicate rosettes, or C-shaped bodies. In two genera the spicules reduced to minute grains or rods.

Chiefly restricted to tropical shores, with three genera in colder waters or extending to a depth of several hundred fathoms.

Type genus: Stichopus Brandt.

Remarks: In 1922 H. L. Clark subdivided the old genus *Stichopus*, and the four genera he accepted have been more or less recognized. In 1948 a new genus was added by Deichmann, and the division is now completed by the addition of two more genera, of which one is char-

acteristic of the Panamic and West Indian region. A key is given to the seven genera to explain the present arrangement.

Key to the genera of the family Stichopodidae

1. No tables in skin, only minute grains or rods. 2
1. Numerous to few tables in the skin. 3
2. Dorsal papillae united into complex leaflike structures. East Indian reefs. . . . . *Thelenota* Brandt
2. Dorsal side with numerous small feet or papillae. West Indies. (Position doubtful) . . . . *Astichopus* H. L. Clark
3. Synallactidlike forms, cylindrical, with few large papillae on the dorsal side and comparatively few feet in bands on the ventrum. In colder waters or to a depth of several hundred fathoms. 4
3. Flanks more or less thickened. 5
4. Tables, gradually becoming reduced, and delicate buttons with two lateral and two terminal holes, often reduced to irregular bodies. South African waters. . *Neostichopus* Deichmann
4. Tables well developed; buttons absent or with several holes along the sides and no terminal holes. North Atlantic, North Pacific, and New Zealand waters. *Parastichopus* H. L. Clark
5. Numerous small papillae along side of ventral sole. Tables with large disk with several circles of holes. Atlantic Ocean, in deeper water. . . . . *Eostichopus* n. gen.
5. Comparatively few large papillae along the side of ventral sole. 6
6. Tables with four clusters of few spines on spire; disk mostly with four central and four marginal holes. Often fragile rosettes and C-shaped bodies. Indo-West Pacific tropical shore forms. . . . . *Stichopus* Brandt
6. Tables with wreath of small spines on spire; disk mostly with circle of many small holes. No delicate rosettes, but C-shaped bodies often present. Shores of the tropical region of the American waters. . . . . *Isostichopus* n. gen.

Isostichopus n. gen.

Stichopus auctores (*partim*).

Diagnosis: Large form with thickened flanks and (in the full-grown animal, with a length of about 25 cm) up to 20 blunt lateral

papillae, and a similar number in the dorsal rows. Sole well developed, with three bands of cylindrical feet. Spicules a dense layer of low, squat tables; in the adult, with a circular disk with 8 to 12 small holes, single crossbeam, and a wreath of small spines on the top; C-shaped bodies present in varying numbers and sizes. Feet with large end plate and large supporting plates with numerous holes; smaller curved rods or plates in the dorsal appendages. Dorsal appendages usually lacking end plate. Tropical shores of America.

Type species: *Stichopus badionotus* Selenka.

Key to the species of *Isostichopus*

Tables taller than wide; profile of tables rectangular. Color variable, from black to orange, often spotted or striped. Common in the West Indies, including Bermuda. *badionotus* (Selenka)

Tables about as wide as tall; profile roughly quadrate. Color uniformly chocolate brown with paler ventral side; young more lightly colored, often with a faint reticulum of darker brown on the dorsum. Tropical west coast of Mexico, Central and South America. . . . . *fuscus* (Ludwig)

Isostichopus fuscus (Ludwig)

Pl. 1, figs. 1-3

Stichopus fuscus Ludwig, 1875, p. 97; 1898, p. 5, pl. 1, figs. 1-5. H. L. Clark, 1910, p. 350 (not examined); 1922, p. 45 (rejected as unidentifiable). Deichmann, 1937. p. 163; 1938, p. 363. Steinbeck & Ricketts, 1941, p. 410.

Stichopus badionotus Selenka, 1867, p. 316 (*partim*). H. L. Clark, 1922, p. 55 (*partim*).

Non Stichopus fuscus Théel, 1886a, p. 5 (*Parastichopus californicus* (Stimpson), from San Diego, California).

Diagnosis: See diagnosis of genus and key.

Type: Possibly in Germany.

Type locality: "Patagonia," probably wrong. As a substitute one might use Machalilla, Ecuador, from which locality Ludwig reported it in 1898.

Distribution: Common from Ecuador to the upper end of the Gulf of California; also in the Galapagos, Socorro, and Cocos Islands. Not known from the western coast of Lower California or from California.

Depth: From shore to about 20 fathoms.

Specimens examined: Several in various collections in the United States and Europe. A total of 35 collected by the Hancock expeditions from 29 stations.

Remarks: The *Velero III* material has confirmed the correctness of the differences previously listed for the two members of the genus. More important than actual measurements are the proportions of the tables—narrower in the Atlantic species, almost square in side view in the Pacific form.

The *Velero* material, as well as that which Dr. Mortensen brought back from Panama in 1916-1917, ranges in length from a few to about 20 cm; the animals shrink considerably when preserved and for practical reasons one avoids picking up the largest individuals, which are more difficult to preserve before they have time to dissolve into slime. In the young individuals, which are paler in color and have fewer appendages, one finds often larger, more delicate tables, with a tall fragile spire and four central holes surrounded by 4 to 10 smaller ones, similar to those found in *Parastichopus* and *Stichopus* of similar age.

Steinbeck & Ricketts note that the species is extremely common in favorable sheltered localities and say that they could easily have collected fifty individuals in a short time in the lagoon at Puerto Escondido, in the Gulf of California.

II. Holothuriidae

Diagnosis: Aspidochirote holothurians with respiratory trees, *rete mirabile*, well developed tentacle ampillae, and the gonads in a single tuft to the left of the dorsal mesentery. Tentacles 20 to 30, in most species 20; mouth terminal or ventral in position. Shape of body varying from cylindrical to flattened, with appendages in different arrangement and different development, as cylindrical tube feet or more papilliform, with sucking disk reduced or lacking. Spicules diversified, in most forms an outer layer of tables, absent or reduced in some groups; in addition often an inner layer of buttons—regular or irregular, knobbed or smooth—rosettes, rods or plates. With the outer layer of tables lacking or reduced, the inner layer usually well developed (except in some of the surf-loving forms with very few spicules). Tube feet mostly with end plate and a varying number of supporting rods or plates; in the papillae, end plate reduced or lacking and rods, if present, mostly curved and short.

Mostly shallow water forms living in the tropical region, either freely exposed in the lagoon, or concealed among rocks, hidden in sand or mud, or attached to rocks in the surf zone. A few species descending to a depth of 200 to 250 fathoms and some extending into colder waters.

Type genus: "Holothuria" Linnaeus 1758.

Remarks: The history of this family is rather exasperating. The original genus *Holothuria* of Linnaeus, listed in the 10th edition with four species, is based on some of the large siphonophores, such as *Physalia,* as was pointed out by T. Gill in Science, 1907, p. 185, in a critical attack on W. K. Fisher. The latter (*ibid.*, p. 389) admitted the correctness of this fact, but posed the question of what to do with a name which has been as well established as the word "mammal," and how to get around the use of the word Holothurioidea, etc. Linnaeus' name was at first accepted as the name for all the common tropical aspidochirotes; but in the course of time the most characteristic forms were segregated under new generic names, and various writers strove to arrange the remaining large number of species in a more or less natural order, using the distribution of the feet, the spicules, and other features. In these efforts they were greatly handicapped by the incompleteness of the earlier descriptions.

In 1914 Pearson attempted to subdivide the large genus *Holothuria* on the basis of his knowledge of a very limited fauna, that of Ceylon. Unfortunately he selected the poorest, most artificial of all systems, that of Brandt, with its many useless generic names—useless because in many cases one cannot recognize the species he describes and in others his definitions are so broad that almost any species could be included in the genus. Pearson's system has more or less been adopted by Heding and Panning. To the latter we are indebted for a most careful revision of the genus *Holothuria*, as well as *Bohadschia* and *Actinopyga*; for some reason he did not include the small genus *Labidodemas.*

Panning included about 120 species in *Holothuria s. l.*, subdivided into smaller groups which unfortunately are not clearly defined. Of these species, about 40 can either be withdrawn as synonyms of well known forms or are so incompletely described that they must be rejected. About 80 species remain. Twenty are here reported from the Panamic region, plus *Mertensiothuria platei*, from Juan Fernandez, which possibly may be found to range into the region under discussion. Two of these species were not included in Panning's report, and one of them is new.

The material discussed here is divided into 13 genera, which take in the majority of the known species. Whenever possible, all the species referred to a genus have been included in the key; in other cases a tentative list is given of the species which probably should be referred to the genus. As for the genus *Holothuria* L., which has no right to exist, one might abandon it completely, using the name as a colloquial term, like "amphioxus," which covers all lancelets; or one might select as its type one of the oldest and best known species from the Mediterranean, such as *Holothuria poli* delle Chiaje, which possibly may have been the form Aristotle had in mind when he gave the first description of these animals.

Key to the genera of the family Holothuriidae from the Panamic region

1. Skin gelatinous, soft. Appendages restricted to the ambulacra, not numerous. Calcareous ring unusually low and delicate with almost ribbonlike interradialia. Spicules tables, not numerous, and in some species a few buttons, usually twisted and incomplete, suggesting clumsy C-shaped bodies. Color white or golden brown, mostly with darker appendages. . . . . 1. *Labidodemas* Selenka
1. Skin not gelatinous, soft. If appendages restricted more or less to the ambulacra, the spicules numerous. Calcareous spicules variously developed, rarely with tables completely lacking; and in that case spicules of other forms—rods, buttons —present in the inner layer. 2
2. Skin with few to many spicules, never rigid from being packed with spicules. 3
2. Skin parchmentlike, stiff, packed with spicules. Burrowing forms. 11
3. Tables forming a close outer layer. Disk usually lacking; spire tall, ending in a few strong spines, forming a Maltese cross when seen from above. Inner layer lacking, or consisting of scattered huge, flat bars. Slender form, cylindrical or bottle-shaped, with small terminal tentacles. Under rocks. (*languens* group) . . . . . 6. *Semperothuria* n. gen.
3. Tables variously developed but not forming a crowded outer layer and not lacking the disk. If tables lacking or rare, a deeper layer of rods, buttons or rosettes is developed. . . 4

4. Inner layer consisting of regular smooth buttons. Tables more or less well developed, with disk and small teeth, few to many on the tip of the spire. 5
4. Inner layer, if present, not as regular smooth buttons but as rosettes, rods or plates, or partly irregular, more or less twisted buttons. Tables variously developed, lacking in one genus. 6
5. Buttons large, thin, with 3 to 5 pairs of small holes. Animals flattened, with numerous ventral feet, large ventral tentacles, and few warts on dorsum. Under rocks. (*difficilis* group) . . . . . . 2. *Microthele* Brandt, Panning emend.
5. Buttons small, with three pairs of holes, large to small, even to the point of obliteration. Cylindrical to flask-shaped forms, with small terminal tentacles. Concealed among rocks or in sand. (*arenicola* group) . . 3. *Brandtothuria* n. gen.
6. Tables lacking except as vestiges in young individuals. Spicules spinous to smooth rods, or small plates or curved bars with a varying number of holes. Soft-skinned, with numerous feet on the ventrum and small papillae on dorsum. Tentacles large, often bushy, almost dendritic. Living attached to rocks, often in surf zone. (*lubrica* group) . . . . 10. *Selenkothuria* n. gen.
6. Tables present, though in some forms rare. 7
7. Tables of moderate size or small, with small disk. Spicules in inner layer rosettes or small perforated plates or incomplete buttons. Free living, in lagoons. 8
7. Tables large, delicate or robust, either alone or with mostly irregular, twisted buttons. 9
8. Tables with small disk, moderate to high spire and 8 to 12 sharp spines on top, eight forming a Maltese cross. Inner layer small rosettes or small perforated plates. (*atra* group) . . . . 9. *Ludwigothuria* n. gen.
8. Tables low, degenerate, often incomplete. Inner layer as smooth buttons, often incomplete, or as oblong rosettes. (*leucospilota* group) . . 5. *Mertensiothuria* n. gen.
9. Tables alone, numerous, with large disk and four slender rods arising as parallel columns and turning outward at the top; one basal crossbar. Smaller tables with reduced spire in the feet. Slender, cylindrical to flask-shaped, with few feet in scattered rows. (*maccullochi* group) . . . . 7. *Irenothuria* n. gen.

9. Tables variously developed, but not with four slender columns curving outward at the top. 10
10. Clumsy tables with low spire and margin of disk often dentate. Buttons regular to irregular, often twisted or incomplete. Small cylindrical forms with small terminal tentacles. Under rocks. (*pardalis* group) . . 4. *Lessonothuria* n. gen.
10. More or less irregular tables, often with dentate margin and a cluster of irregular sharp spines on top of the spire. Buttons large, often irregular, becoming smaller and more regular with age; buttons lacking in one form. Large cylindrical body with small ventral tentacles and a moderate number of ventral feet, and still fewer papillae on the dorsum and along the flanks. Usually with a pale area around the base of the mostly darker appendages. In deeper water, 50 to 250 fathoms. (*lentiginosa* group) . . . 8. *Vaneyothuria* n. gen.
11. Tables well developed, with knobby margin and spire often transformed into a reticulated mass. Buttons regular, strongly knobbed; longer on the ventrum and may here show a tendency to become less knobby with age. Flattened forms with small ventral tentacles and small feet and papillae. (*rigida* group) . . . . 11. *Fossothuria* n. gen.
11. Tables with tendency to become reduced, spire never forming a large reticulated mass. Buttons irregular, often twisted or incomplete, with or without irregularly scattered knobs. 12
12. Stout forms with ventral tentacles and large ventral sole of cylindrical feet, back covered by conical papillae. Calcareous ring stout, of normal shape. (*inhabilis* group) . . . . 12. *Jaegerothuria* n. gen.
12. Stout form with cylindrical body and small terminal tentacles. Conical appendages dorsally and ventrally, on the ventrum ending in a retractile cylindrical tube foot. Calcareous ring with short posterior prolongations on the radials. (*princeps* group) . . . . 13. *Theelothuria* n. gen.

1. **Labidodemas** Selenka 1867

Labidodemas Selenka, 1867, p. 309.

Diagnosis: Medium-sized species, up to 15 cm long, with 20 small tentacles terminally placed, anus subterminal. Feet few, in single to double rows along the radii, rarely spreading out into the interambul-

acra; ventrally cylindrical, dorsally more papilliform. Calcareous ring delicate with very elongate ribbonlike interradialia. Color white to golden brown, mostly with dark appendages and tentacles. Skin soft, thick, gelatinous.

Spicules few, as scattered tables, stout or delicate; in the type species a few buttons present, deformed or incomplete, suggesting clumsy C-shaped bodies.

Type species: *Labidodemas semperianum* Selenka.

Remarks: Three species previously described were united by Sluiter (1901) under one name. At the same time he established a rather doubtful new species without any spicules. Ludwig's *Holothuria pertinax* (see Panning, 1934, III, p. 75, text-fig. 57) is withdrawn as a synonym of *Labidodemas semperianum*. A new species of *Labidodemas* was described from the Panamic region in 1938.

Labidodemas americanum Deichmann 1938

Pl. 1, fig. 5

Labidodemas americanum Deichmann, 1938, p. 363, text-fig. 1.

Diagnosis: As for the genus, but spicules delicate tables with four central holes, a circle of about ten marginal holes, of which some may be imperfect, and often a few blunt marginal teeth; spire sometimes reduced to four knobs. Large cylindrical feet on the ventrum with a large end plate and a few small plates with 4 or 5 holes, possibly representing reduced tables; the dorsal appendages papilliform and seemingly lacking the end plate completely, but with small plates in the walls, similar to those in the ventral feet.

Color varying shades of golden brown, inclining toward greenish; usually dark brown appendages and tentacles, in some specimens faded.

Type: Museum of Comparative Zoology.

Type locality: Costa Rica, Jasper Island.

Distribution: Known from Galapagos Islands, Cocos Island, Costa Rica, and Espiritu Santo Island, Gulf of California.

Depth: Shore.

Specimens examined: The types and the 13 specimens collected by the Hancock expeditions—Galapagos Islands, 8 specimens from 4 stations; Cocos Island, 2 specimens; Espiritu Santo Island, 3 specimens.

Remarks: The Hancock material ranges in length from 2 to 7 cm and varies somewhat in color; in some specimens the ventral appendages are almost white. The species is well characterized and quite distinct

from the widespread type species described from Hawaii, which has rather stout tables with long spines on the tip of the low spire, and in addition a few deformed buttons. Both the type species and the present form appear to be rather rare, and one has the impression that the genus is a survival of a primitive, synallactidlike type which has been able to hold its own in some parts of the tropical shore region.

2. **Microthele** Brandt 1835

Microthele Brandt, 1835, p. 54. Panning, 1929, I, p. 130 (*partim*).
Mülleria auct. (*partim*).
Actinopyga auct. (*partim*).

Diagnosis: Medium-sized to large forms, with 20 large ventral tentacles and numerous cylindrical feet on the ventral side, the dorsal side with scattered low papillae, often placed on low warts. Anus terminal with calcified papillae; with the skin scraped off, these papillae simulate anal teeth. Cuvierian organs large.

Spicules an external layer of crowded tables with well developed disk having a varying number of holes and round to squarish in outline; spire low, squat, with a single crossbeam and many short spines on the top. An inner layer of large thin buttons, oval or slightly S-shaped, with two rows of comparatively small holes. Ventral feet with large end plate and large plates, more or less symmetrically developed with numerous holes; dorsal appendages with reduced end plate or none, and more simple rods.

Color varying shades of brown, in one form with the papillae surrounded by a pale area. A green fluorescent pigment present in one species (*M. parvula*), possibly in all.

Type species: Holothuria sanctori delle Chiaje.

Remarks: The name *Microthele* is accepted in the sense in which Panning used it in 1929, pp. 130-138, with some corrections, in order to avoid an endless reshuffling of names. Brandt's diagnosis, 1835, p. 54 "Dorsi pedes parum evoluti, rarius ex eminentiis mamillosis parum distinctis prominentes," fits the members of the *Holothuria difficilis* group—as well as many others.

Of the nine species which Panning lists, *Holothuria* (*Microthele*) *nobilis* (Selenka) (and *Holothuria whitmaei* Bell) must be transferred to another genus; *Holothuria (Microthele) aegyptiana* (Helfer) was based on a poorly developed individual of the *rigida* group. *Holothuria (Microthele) lubrica* (Sluiter), based on two specimens 4.2 cm long,

from Thursday Island, appears to be young individuals of *Mertensiothuria leucospilota* (Brandt). The remaining six species are reduced to three: *Microthele difficilis* (Semper), including *Holothuria excellens* (Ludwig), *H. bedfordi* (Deichmann), and *H. altimensis* H. L. Clark; *Microthele sanctori* (delle Chiaje), with its synonym *Holothuria flavocastanea* (Théel); and *Microthele parvula* (Selenka).

Key to the species of the genus *Microthele* Brandt, emend. Panning

1. Large species, 20 cm, brown with paler area around the dorsal papillae. Mediterranean, Eastern Atlantic, as far south as St. Helena. . . . . *sanctori* (delle Chiaje)
1. Small to medium-sized species. Color uniformly brown or yellow. 2
2. Specimens about 5 cm long, color light brown or yellow. Buttons comparatively narrow, often S-shaped. West Indies, including Bermuda. . . . . *parvula* (Selenka)
2. Specimens up to 10 to 12 cm long; color usually dark brown. Buttons broad oval. Indo-Pacific. . . . *difficilis* (Semper)

Microthele difficilis (Semper)

Pl. 1, figs. 6-9

Holothuria difficilis Semper, 1868, p. 92, pl. 30, fig. 21. Panning, 1929, I, p. 136, text-fig. 20 (copied from various authors), complete list of references. Deichmann, 1937, p. 164. Steinbeck & Ricketts, 1941, p. 407.

Mülleria excellens Ludwig, 1875, p. 98, pl. 7, fig. 32.

Holothuria (Microthele) excellens, Panning, 1929, I, p. 132, text-fig. 16 (copied from Ludwig).

Actinopyga bedfordi Deichmann, 1922, p. 212.

Holothuria (Microthele) bedfordi, Panning, 1929, I, p. 136, text-fig. 19 (copied from Bedford).

Holothuria frequentiamensis H. L. Clark, 1902, p. 530. Panning, 1934, III, p. 73.

Holothuria altimensis, H. L. Clark, 1921, p. 172, pl. 37, figs. 20-29. Panning, 1935, IV, p. 94, text-fig. 82 (copied from H. L. Clark).

Diagnosis: Medium-sized form, 10 to 12 cm long, usually dark brown, sometimes almost purplish black, rarely more yellow. Spicules a

crowded layer of tables with about 8 holes in the disk, often with smaller holes intercalated between them; spire low with numerous spines on top. Buttons broad oval with three to five pairs of small holes. Ventral feet with large end plate and broad plate-like supporting rods, often with slitlike holes.

Types: Semper's cotypes are in the Museum of Comparative Zoology, as well as the types of H. L. Clark's *Holothuria frequentiamensis* and *H. altimensis*.

Type localities: Semper's types came from Samoa, as did *Holothuria excellens*. Clark's types came respectively from Clipperton Island, eastern Pacific, and Torres Strait, Australia.

Distribution: From the eastern coast of Africa westward to the tropical coasts of Central America and Mexico.

Depth: Shore, mostly under flat rocks in pools.

Specimens examined: The paratypes and types listed above, and a large series from various localities in different collections, including Bedford's material in the British Museum. One hundred and eight specimens from 22 stations, collected by the *Velero III*. Of these, 46 came from the Galapagos Islands, one from Cocos Island, 8 from Clarion Island, 25 from Panama, 15 from Costa Rica, and 13 from the coast of Mexico, as far north into the Gulf of California as Espiritu Santo Island. The species was not taken at San Lucas or along the west coast of Lower California. Its absence in Socorro Island may be accidental, as the species is common both in Clarion Island and Clipperton Island.

Remarks: The *Velero* material ranges in length from 2 to 8 cm; but as the largest individuals are somewhat contracted, they probably measured at least 10 cm when expanded. The color shows some variation from light brown, almost yellow, to dark purplish brown or black. In many localities the individuals had undergone transverse division, so one finds the usual "stumpy" specimens with too large a tentacle crown and closed posterior end, or a posterior end with a regenerating, pale anterior end, as described by Deichmann in 1922.

The spicules are distinctly different from those of the smaller *Microthele parvula* from the West Indies and Bermuda, as previous studies have shown. In addition, W. K. Fisher found that the Cuvierian organs were ejected as "long sticky threads" in *M. parvula*, while Mortensen found them to be discharged as minute vermicellilike fragments in *M. difficilis* (verbal communication). Whether the green pigment so char-

acteristic of *M. parvula* also occurs in *M. difficilis* is not known, as all the Pacific material has been so well cared for with fresh alcohol that no trace remains in the material I have seen.

The species is common both in Hawaii and in Easter Island, and from the abundance with which it occurs in the Hancock collections one seems justified in considering it a permanent element in the Panamic region.

Clark's *Holothuria frequentiamensis*, from Clipperton Island, was previously withdrawn as a synonym of *Microthele difficilis* and the same fate must befall Deichmann's *Actinopyga bedfordi*, based on some young specimens from Funafuti and Rotuma, identified as *Holothuria parvula* by Bedford. Clark's *Holothuria altimensis*, from Thursday Island, has also proved to be a young *Microthele difficilis* in which a few "synallactid" tables with cross-shaped disk were preserved—a feature which, as the Hancock material has shown, may exist also in other species.

3. **Brandtothuria** n. gen. (**Holothuria arenicola** group)

Diagnosis: Comparatively slender, spindle- or bottle-shaped forms, of moderate size, rarely 25 cm long, with 20 small terminal tentacles and terminal anus. Appendages not numerous, more papilliform on the dorsum, and often distinctly arranged in five bands. Inner anatomy not remarkable except in *Brandtothuria arenicola* (ring canal placed some distance behind the calcareous ring); usually one stone canal and one or two Polian vesicles; Cuvierian organs present, variously developed.

Spicules an external layer of tables with smooth edged disk and, in the adult, a low spire with a varying number of teeth; in young individuals, the spire sometimes tall with several crossbeams. Inner layer of smooth buttons of moderate size, usually with three pairs of holes. Ventral feet with large end plate and supporting rods or plates, dorsally small end plate or none, and supporting rods more narrow and often curved. Usually concealed among rocks or buried in sand or mud.

Type species: *Holothuria arenicola* Semper.

Remarks: At the present moment the genus is restricted to three species, all included by Panning in "*Sporadipus*" without making it clear what characterizes that group. It seems to be a large motley array of mostly unrelated forms. Brandt used the name for two species, *S. ualanensis* and *S. maculatus*, which cannot be identified, although many think that the last named, from Bonin Island, may be the same form

that Semper later called *Holothuria arenicola* (see Fisher, 1907, p. 662).

All three species occur in the Panamic region, but while two of them are extremely common and also occur in the West Indies, the third, with only a few scattered locality records, appears to be a visitor from Hawaii or some other outlying West Pacific island group.

Key to the species of the genus *Brandtothuria*

1. Tables stout, with about 8 marginal holes in the almost squarish disk; spire low, squat, with numerous short spines on the top. Buttons regular with six large holes. Color mottled gray to reddish brown; skin rough to the touch, animals usually strongly warted. Almost circumtropical. . . . . *impatiens* (Forskål)
1. Tables not remarkably stout; disk circular or with four marginal holes; spire more or less tapering, with a varying number of spines. 2
2. Disk of tables normally circular with several small holes. Buttons delicate, elongate, with six large, narrow holes. Color golden brown with a circular pale area around the appendages, which may be dark brown. Ranges from East Africa to the west coast of tropical America. . . . *gyrifer* (Selenka)
2. Disk of tables often reduced to the central four holes. Buttons small with six small holes, often partly obliterated ventrally. Color whitish gray to light brown, often with two rows of black spots on the back, or small black specks scattered all over the animal. Rusty red or black specimens may be found, stained by the mud in which they live. Almost circumtropical. . . . . *arenicola* (Semper)

Brandtothuria arenicola (Semper)

Pl. 1, figs. 10-13

Holothuria arenicola Semper, 1868, p. 81, pl. 20; pl. 30, fig. 13; pl. 35, fig. 4. Panning, 1935, IV, p. 88-89, fig. 73, almost complete list of references. Deichmann, 1938, p. 364. Steinbeck & Ricketts, 1941, p. 407.

Holothuria monsuni Heding, 1939, pp. 217-218, figs. 18-26.

Diagnosis: Slender spindle-shaped form, up to 20 cm long, mostly about 10 to 16 cm in length. Feet scattered in indistinct bands, ventrally

cylindrical, dorsally partly papilliform or at least with smaller disk. Internally, ring canal placed exceptionally far behind the calcareous ring. Cuvierian organs present but apparently always small.

Spicules an outer layer of tables with 4 to 8 marginal holes and low spire, often with pillars slightly converging and few small spines on the top. Buttons small, smooth, with six holes, usually smaller on the ventrum, here becoming completely obliterated with age. Ventral feet with end plate and almost straight supporting rods with perforated ends, or with a series of holes along the sides making them into elongate buttons. Dorsal feet with smaller end plate or none, and shorter rods, often curved.

Color white to gray with a varying amount of dark pigment flecks or two rows of dark spots on the dorsum. Some individuals almost black or covered by a reddish pigment, possibly from the mud in which they live.

Type: Possibly in Germany.

Type locality: Bohol, Philippines.

Distribution: Almost circumtropical, in shallow pools, usually concealed in mud or sand. Common in the West Indies, including Bermuda, as well as in Hawaii. In the Panamic region it has been found to range from Ecuador to the upper end of the Gulf of California (30° N). Extremely common in the Galapagos Islands, where 47 individuals were secured at 17 stations. Also taken at Cocos and Clarion Islands.

Depth: Shallow water, mostly hidden in mud or sand, rarely among rocks.

Specimens examined: A large number in various collections. In the Hancock collections more than 150 individuals were examined, ranging in size from 3 to 15 cm.

Remarks: The material from the Panamic regions shows the same lawless variation as that exhibited by the material from the West Indies. Animals with two rows of dorsal spots occurred with others of the same size in which minute specks of black were scattered over the entire animal. As in material from other localities, one often finds no buttons in the youngest individuals (few cm long), and in these the layer of tables is better developed, with larger disk, complete circle of holes, and a taller, more delicate spire.

Steinbeck & Ricketts report the species as fairly common in the Gulf of California and the *Velero* expeditions have proved that it is about the third most common species in the Panamic regions, with the Galapagos Islands being the place where it finds optimum conditions. From here it

was reported by Théel as early as 1886, and later by the *Zaca* and the *Arcturus*, which also reported it from Costa Rica. Ludwig's *Holothuria maculata*, from 66 fathoms off Cocos Island, refers to *Jaegerothuria inhabilis*, while his *Holothuria arenicola*, from shallow water in Panama, is correctly identified.

Strongly contracted specimens have occasionally been mislabelled *Holothuria impatiens*, which occurs in similar localities, though preferably among rocks. Superficially the species resembles *Lessonothuria pardalis*, but the spicules are sufficiently different to prevent a misidentification.

Brandtothuria impatiens (Forskål)

Pl. 1, figs. 14–15

Fistularia impatiens Forskål, 1775, p. 121, pl. 39, fig. B.

Holothuria impatiens, Panning, 1935, IV, p. 86, complete list of references. Deichmann, 1938, p. 365. Steinbeck & Ricketts, 1941, p. 407, pl. 10, fig. 2. Cherbonnier, 1951, p. 29, pl. 9, figs. 8-9.

Diagnosis: Medium-sized form up to about 15 cm long, rarely longer. Often distinctly bottle-shaped with a long "neck." Feet in indistinct rows, large ventrally, more papilliform on the dorsum, often placed on low round warts. Internal anatomy not remarkable; usually with enormous thick tubes of Cuvierian organs.

Spicules a crowded layer of stout tables, with eight large holes, about as large as the central hole. Spire short, stout with one or two crossbeams and a wreath of numerous short teeth on the top. Buttons smooth, regular, usually with six large holes. Feet with end plate, smaller in the dorsal appendages; supporting rods curved, with terminal holes, occasionally with lateral holes, giving them the form of large buttons.

Color mottled gray or brown, sometimes almost uniformly reddish brown. Skin unusually sandy to the touch.

Type: Undoubtedly lost.

Type locality: Red Sea.

Distribution: Almost circumtropical, common in the West Indies, and ranging all over the tropical Indo-Pacific. In the Panamic region, ranging from Colombia to the upper end of the Gulf of California, also in the Galapagos Islands and Cocos Island. Most remarkable is that it occurs on the west coast of Lower California, at Magdalena Bay and Cedros Island.

Depth: Shallow water to a few fathoms, usually well concealed among rocks, more rarely in sand.

Specimens examined: Several in various collections in America and Europe. The Hancock collections contain about 328 individuals, collected at 85 stations.

Remarks: Steinbeck & Ricketts report *Brandtothuria impatiens* as the second most common species in the Gulf, and the methodical collecting of the Hancock expeditions have confirmed this estimate and further shown that it is the most common form in the Galapagos Islands, where 72 individuals were collected at 22 stations. It is a species which usually is represented in all collections, but mostly by few individuals in each. The large number found in the Panamic region may indicate that the conditions there are particularly favorable for this widespread form.

Brandtothuria gyrifer (Selenka)

Pl. 1, figs. 16-18

Stichopus gyrifer Selenka, 1867, p. 319.
Holothuria gyrifer, Deichmann, 1938, p. 371 (discussion of synonymy).
Holothuria monacaria, Panning, 1934, III, p. 69 (*partim*), list of references.

Diagnosis: Slender, spindle-shaped or flask-shaped form, up to 20 cm long, usually less than 15 cm. Resembling *Brandtothuria impatiens* but more delicate, with less rough surface, and skin invariably yellowish brown in color with large pale areas around the appendages, giving a distinct polka dot effect. Anatomy similar to *B. impatiens*, but Cuvierian organs small.

Spicules an external layer of tables with circular disk having up to ten holes, and tapering spire with few spines on tip. Inner layer consisting of regular buttons with six large holes, rather narrow. Ventral feet with large end plate but no special supporting rods, except a few reticulated plates near the end plate or a few perforated rods or elongated buttons. Dorsal appendages usually without end plate, and curved rods with short transverse projections sometimes developing into a row of lateral holes. Synallactidlike tables in young.

Type: Museum of Comparative Zoology.

Type locality: Hawaii.

Distribution: From east coast of Africa to the Panamic region, where it was first reported by H. L. Clark in 1923 and later taken by the *Zaca* expedition.

Depth: Shallow water, concealed under rocks or in sand.

Specimens examined: The type and several specimens in the Museum of Comparative Zoology, and in other collections. Fourteen specimens collected by the Hancock expeditions from seven stations, ranging from Colombia to Las Tres Marias, Magdalena Island, Mexico (about 21° N).

Remarks: That this well characterized and wide ranging species is not a permanent element in the Panamic region is indicated by the comparatively few records and by the small size of the material, 1 to 8 cm. It probably does not reach maturity in this area.

The coloring in this species is a most reliable character, except in cases of the youngest individuals, 1 to 3 cm long, which may be almost uniformly brown; but the spicules are characteristic enough to separate them from similar age groups of *B. impatiens* and *B. arenicola.*

"*Holothuria patagonicus*" Perrier, well figured in his paper of 1905, lacks spicules completely and is undoubtedly a mislabelled specimen in which the spicules have been accidentally dissolved. It has never been taken since the type was described and must be withdrawn as a synonym of *Brandtothuria gyrifer.*

4. **Lessonothuria** n. gen.
(**Holothuria pardalis** group)

Diagnosis: Small (10 to 12 cm) spindle-shaped forms resembling *Brandtothuria arenicola*, with small terminal tentacles and few feet or papilliform feet in indistinct rows.

Spicules stout tables with disk round, edge smooth to dentate, often incomplete; spire low with 8 to 12 teeth, often reduced. Buttons in inner layer, numerous, often distinctly in heaps, varying from regular, with 6 to 8 holes, to incomplete, often twisted forms, occasionally with one or two knobs. Feet with end plate, smaller in the dorsal ones, and straight to curved supporting rods with few holes in the expanded ends or transformed into elongate buttons.

Type species: Holothuria pardalis Selenka.

Remarks: To this group has been referred only one species which is extremely variable but in which, as all authors seem to agree, the numerous variations cannot be separated. In Panning's revision, the species is placed, with a large number of others, in Group B, ser. 8 (V, p. 3). However, some of the species in this group are synonymous, some belong in other groups, and the few remaining forms, incompletely known as they are, have no close affinities with *Lessonothuria pardalis.*

Lessonothuria pardalis (Selenka)

Pl. 2, figs. 1-17

Holothuria pardalis Selenka, 1867, p. 336, pl. 19, fig. 85. Fisher, 1907, p. 664, pl. 69, figs. 1, 1a-g. Panning, 1935, V, p. 3, fig. 106, complete list of references. Cherbonnier, 1951, p. 31, pl. 9, figs. 17-18; pl. 10, figs. 13-19; pl. 11, figs. 1-11.

Holothuria pardalis var. *cebuensis* Domantay, 1933, p. 70, pl. 3, fig. 4. Panning, 1935, V, p. 4.

Diagnosis: As for the genus. Extremely variable in color, as well as in the shape of the spicules. In some individuals the inner layer of buttons almost entirely composed of regular six-holed buttons, in others almost all deformed, twisted, incomplete or with a few knobs on the surface.

Type: Possibly in Germany.

Type locality: Hawaii.

Distribution: Almost circumtropical, though lacking in the Atlantic Ocean, including the West Indies. Common in Hawaii and extending into the Panamic region, though, judging from the Hancock material, not well established there.

Depth: From tidemark down to a few fathoms. In Hawaii, the *Stranger* collected it at 12 to 20 fathoms.

Specimens examined: Several in various collections. The following specimens from the Hancock expeditions: four recorded from the Galapagos Islands; one from Gorgona, Colombia; one from Cocos Island; two from the Secas Islands, Panama; and one from Tenacatita, Mexico. So far it has not been taken in the sheltered waters of the Gulf of California, which may indicate that it is not a permanent element of the fauna.

Remarks: Fisher observed that it usually occurs under rocks at low tide.

5. **Mertensiothuria** n. gen.
(**Holothuria leucospilota** group)

Diagnosis: Large smooth-skinned forms with large tentacles, terminal or subventral, with cylindrical ventral feet and small papillae on the dorsum. Inner anatomy not remarkable; Cuvierian organs present.

Outer layer of tables poorly developed, at least in the adult, with disk often reduced to plate with four large central holes and in addition

often some smaller marginal ones; spire low, with few teeth on top, often partly resorbed. Inner layer either buttons, mostly irregular, incomplete, often twisted, or in one species reduced to rods with lateral lobes only rarely developing into complete buttons.

Type species: Stichopus leucospilota Brandt.

Remarks: In this genus have been placed a few of the members of Panning's Abt. B, Reihe 1-3, and some of those referred to his Abt. B, Reihe 8. One species from the latter division has turned out to be identical with the type species, placed in his first division. At the present moment, four species have been included in the genus, all exclusively Indo-Pacific; one is known only from American waters, while the fourth, *Mertensiothuria pervicax*, extends as far eastward as Hawaii.

KEY TO THE SPECIES OF THE GENUS *Mertensiothuria*

1\. Spicules in inner layer small oblong rods with lateral projections resembling narrow rosettes, only rarely developed into narrow buttons, mostly incomplete. Mottled. Indo-Pacific as far eastward as Hawaii. . . . . . *pervicax* (Selenka)

1\. Spicules in inner layer buttons, complete or incomplete, rarely regular. 2

2\. Buttons mostly with two narrow holes and one to two smaller pairs in the ends, holes often incomplete. Mottled, gray to brown, paler below. Indo-Pacific, including Panamic region. . . . . *fuscocinerea* (Jaeger)

2\. Buttons variously developed, from almost regular to twisted or irregular or incomplete. 3

3\. Tables usually present, with low spire, ending in a flat circle of 8 to 12 short, blunt teeth. Buttons delicate, mostly with large holes, often narrow. Color faded, reddish or brown. From the eastern coasts of Africa to the Panamic region. . . . . *leucospilota* (Brandt)

3\. Tables usually reduced to four-holed disks, often totally lacking. Buttons stout, mostly incomplete and with holes as a rule round, not narrow. Color bluish black to brown dorsum and pale, more grayish, ventrum. Juan Fernandez Island. . . . . *platei* (Ludwig)

Mertensiothuria leucospilota (Brandt)

Pl. 3, figs. 1-9

Stichopus leucospilota Brandt, 1835, p. 51.

Holothuria leucospilota, H. L. Clark, 1920, p. 149.
Holothuria vagabunda Selenka, 1867, p. 334, pl. 19, figs. 75-76. Panning, 1934, III, p. 67, text-fig. 45 (copied from various workers), complete list of references.
Holothuria lamperti Ludwig, 1887, p. 6. Panning, 1934, III, p. 72.
Holothuria oxurropa Sluiter, 1887, p. 190, pl. 1, figs. 3-5. Panning, 1934, III, p. 72, text-fig. 52 (copied from Sluiter).
Holothuria infesta Sluiter, 1901, p. 20, pl. 6, fig. 4. Panning, 1934, III, p. 73, text-fig. 54 (copied from Sluiter).
Holothuria fusco-rubra Théel, 1886, p. 182, pl. 7, fig. 2.
Holothuria curiosa var. *fusco-rubra*, Panning, 1935, V, p. 5.
Holothuria homoea H. L. Clark, 1938, p. 533, text-fig. 56; 1946, p. 438.
Holothuria gelatinosa Heding, 1939, pp. 213-216, figs. 1-17.

Diagnosis: Large, baglike form, rarely contracted, the skin then appearing thick. Tentacles of moderate size, terminal to subterminal; ventrally large tube feet not too numerous, dorsally small papilliform appendages, rather scattered.

An external layer of tables with complete to incomplete disk often reduced to four central holes and 1 to 4 marginal holes, edge smooth to spinous; spire low, likewise often partly reduced, when complete ending in a flattened crown of 8 to 12 blunt teeth. Ventral feet with large end plate and a few broad supporting plates with oblong holes at right angle to the axis; dorsal papillae with reduced end plate or none, and curved rods with perforated ends, often spinous.

Color faded reddish or brown, often paler on the ventrum.

Type: Brandt's types are possibly lost. Selenka's type is in the Museum of Comparative Zoology, as is that of Clark's *Holothuria homoea*, while Théel's are in the British Museum.

Type locality: Brandt's type came from Ualan, Marshall Islands, Clark's from Lord Howe Island, while Selenka's and Théel's material was collected in Hawaii.

Distribution: While Brandt's name has been almost completely forgotten, Selenka's species appears in many reports, with a distribution from the eastern coast of Africa to the Panamic region; an almost identical distribution is indicated for Théel's species.

Depth: Shallow water to a few fathoms.

Specimens examined: Selenka's cotype of *Holothuria vagabunda*; Théel's *Holothuria fusco-rubra* and Clark's *Holothuria homoea*. A large number of specimens in various collections, indifferently identified

as either *H. vagabunda*, *H. leucospilota*, or *H. fusco-rubra.* The Hancock expeditions have brought back 32 specimens from five stations in the Galapagos, Clarion, and Socorro Islands, with the majority of the material coming from the Galapagos region. A number of particularly large, well developed, mature individuals were collected by an expedition from the Scripps Institution of Oceanography to Clipperton Island, indicating that the species obviously is at home in that locality.

Remarks: When one compares the original descriptions of *Holothuria vagabunda* and *H. fusco-rubra*, as well as various later, often extremely careful accounts, one is struck by the impossibility of finding any character which definitely separates these two forms. Théel seems to be one of the few workers who claims to have had both "species" before him, and he emphasizes the strong affinities which his species has with *H. vagabunda* and "*H. curiosa*." All other writers have identified their material as one or the other of the two forms or have established a new species. Panning examined *H. vagabunda* but relied on the accounts of other authors for his description of *H. fusco-rubra*, which he placed in an entirely different group. Both "species" came from Hawaii, and as both were based on large individuals about 20 cm long in preserved condition, one cannot accept one species as the juvenile and the other as the senescent stage of the same form.

Although little attention has been paid to Brandt's name, *Stichopus leucospilota*, there is no doubt that it rightly supersedes both Selenka's and Théel's names. Lampert was fully aware of this fact but decided to retain Selenka's name. In 1920, H. L. Clark changed *Holothuria vagabunda* to *Holothuria leucospilota*; and since the change has been made and incorporated in his two large works on the Australian echinoderms, it is to be hoped that future writers will follow his decision and also drop Théel's name *fusco-rubra.*

Mertensiothuria platei (Ludwig)

Pl. 3, figs. 10-12

Holothuria platei Ludwig, 1898, p. 432, pl. 26, figs. 1-14. Deichmann, 1924, p. 381, text-fig. 1. Panning, 1935, V, p. 11, text-fig. 118.

Diagnosis: Large form, up to 23 cm long, stout, cylindrical, with 20 large bushy tentacles, and a large number of cylindrical tube feet on the ventrum and somewhat fewer small papillae on the dorsum. Inner anatomy not remarkable.

Spicules a scattered layer of tables, often overlooked, with disk reduced to four central holes and a few marginal ones, and an often in-

complete spire. Buttons clumsy, often slightly angulate and mostly incomplete; holes mostly circular or broad oblong, not slitlike. Ventral feet with end plate and elongate supporting rods with a complete or incomplete series of holes around the edges. Dorsal papillae with small end plate and shorter supporting rods.

Color varying from light brown, with pale grayish white underside, to almost black dorsum; tentacles dark, ventral feet usually pale with darker end disk.

Type: Hamburg.

Type locality: Juan Fernandez Island, Chile.

Distribution: Known only from the type locality.

Depth: Collected at tidemark.

Specimens examined: Various individuals in the Museum of Comparative Zoology, Zoologisk Museum, Copenhagen, and Riksmuseet, Stockholm.

Remarks: The species appears to occupy a rather isolated position, but with its reduced tables and large irregular buttons it seems to belong most naturally with the *Mertensiothuria leucospilota* group. From the size of the bushy tentacles and the numerous tube feet, one is inclined to think that its mode of life is similar to that of the members of the *Selenkothuria lubrica* group, attached to rocks in the surf zone, and possibly using its tentacles for collecting a certain amount of planktonic detritus; as far as I know there are no observations on its biology.

The species is included in this report, as it possibly may be found on the shores of the mainland and even extend its range into the Panamic region.

Mertensiothuria fuscocinerea (Jaeger)

Pl. 3, figs. 13-23

Holothuria fusco-cinerea Jaeger, 1833, p. 22. Semper, 1868, p. 88, pl. 27 (in color); pl. 30, figs. 22a-b. H. L. Clark, 1946, p. 435.

Holothuria curiosa Ludwig, 1875, p. 110, pl. 7, fig. 29. Panning, 1935, V, p. 4, text-fig. 107 (copied from Théel), complete list of references.

Holothuria pluricuriosa Deichmann, 1937, p. 166, text-fig. 1, nos. 11-20.

Holothuria pseudo-zacae Cherbonnier, 1951, p. 23, pl. 6, figs. 1-19, 21.

Diagnosis: Large form, up to 30 cm long, with 20 large ventral tentacles and not too crowded appendages; cylindrical feet on the ventrum and papillae on the dorsum. Inner anatomy not remarkable. One

or two Polian vesicles, one or more small free stone canals; large Cuvierian organs present.

Spicules an external layer of tables, usually scattered, with round to squarish disk, often reduced to 3 or 4 central holes and some marginal holes; spire low, often reduced to one rod; if complete, the crown consists of 1 to 4 spines. Inner layer of small buttons, often incomplete, approaching the rosette form of *M. pervicax* (Pl. 3, figs. 24-29); the typical button has two narrow slitlike holes and one or two pairs of minute holes in the ends. Ventral feet with end plate and elongate perforated rods or plates, more or less buttonlike; dorsal papillae with rudimentary end plate and mostly narrow supporting rods.

Color variable, dorsal side ash-gray or brownish, more or less mottled, papillae often with a black area around the base, with a narrow white ring inside it. Ventral side pale gray with a velvet black ring around the base of the retractile feet, which have a pale disk.

Type: Probably not existing in any collection. Semper's specimen upon which he based his excellent description may possibly be in some collection in Germany, where Ludwig's *Holothuria curiosa* may also be kept; *H. pluricuriosa* is in the Museum of Comparative Zoology.

Type locality: Celebes, where Semper's material also came from; *Holothuria curiosa* was collected at Bowen, Australia, and *H. pluricuriosa* came from Santa Ines Bay, Gulf of California.

Distribution: As far as can be ascertained, the species ranges from Ceylon (Pearson), Australia (H. L. Clark and others), Navigator Island (Théel), Samoa and the Philippine Islands (Semper), to the Panamic region. Apparently not reported from the Hawaiian Islands, where *Mertensiothuria pervicax* occurs.

Depth: Shore down to a few fathoms.

Specimens examined: Several in the Museum of Comparative Zoology, from Mer Island, Torres Strait, etc. The type of *Holothuria pluricuriosa*, and the 17 specimens collected at eight stations by the Hancock expeditions, all in the Gulf of California, about 24°-25° N, near Espiritu Santo Island and Escondido, from tide level to 12 fathoms.

Remarks: Panning indicates a length of 10 cm for *Holothuria curiosa*, but Jaeger gives 5 or 6 inches (15 to 18 cm), and Théel, who had occasion to investigate both "species," mentions 18 and 22 cm. Although Jaeger's description is brief, I think it is justifiable to maintain his name, particularly as Semper has given an adequate description based on a series from Jaeger's type locality, Celebes, as well as from Samoa and Bolo. This view is also that held by H. L. Clark in 1946.

That *Mertensiothuria fuscocinerea* is not the last growth stage of *M. pervicax* is certain, since small individuals have been found having the typical egg-shaped buttons with two narrow holes and sometimes one or two pairs of minute holes. Also the Museum of Comparative Zoology possesses huge individuals of typical *M. pervicax.* That the two species are closely related seems evident and they may possibly represent different ecological forms. Judging from the literature and the available material, *M. pervicax* ranges from Zanzibar and the Red Sea to Hawaii.

Re-examination of *Holothuria pluricuriosa* and comparison with other individuals of *Mertensiothuria fuscocinerea* have proved that several stone canals occur frequently in the latter species and that there is an end plate in the retracted feet of the former; therefore *Holothuria pluricuriosa* must be withdrawn as a synonym of Jaeger's old name.

The Panamic material tends to be more dully colored, with larger brown patches on the dorsum, than the typical ash-gray form from the East Indies, and the black areas around the papillae are less clearly pronounced. Nevertheless I do not feel justified in establishing a separate form on the basis of the comparatively few specimens I have examined.

6. **Semperothuria** n. gen.
(**Holothuria languens** group)

Diagnosis: Slender forms, cylindrical to flask-shaped, of moderate size, 10 to 15 cm, rarely 20 cm, with 20 small terminal tentacles and feet in five scattered bands, cylindrical on the ventrum, more papilliform on the dorsum. Inner anatomy not remarkable; Cuvierian organs well developed.

Spicules a crowded layer of tables normally lacking the disk completely and with the tip of the spire ending in a few large teeth, forming a single or double Maltese cross. Rarely a few tables also present with four upward directed spines, or with a complete disk, with smooth or spinous margin. In some species an inner layer present in the form of scattered large, flat bars with dentate edge or a series of large lateral holes. Ventral feet with large end plates, often surrounded by a number of perforated oval plates; numerous large supporting rods in the walls. Dorsal papillae with reduced end plate and usually curved supporting rods.

Color varying shades of purplish gray or brown, paler around the appendages and on the ventrum. Sometimes black dots scattered on the

back, occasionally fusing into larger black spots in two rows. Tentacles pale yellow, except in *Semperothuria flavomaculata.*

Type species: Holothuria languens Selenka.

Remarks: Panning's *imitans* group is accepted with the exclusion of *H. edulis* Jaeger, which is placed near the *atra* group for the present. *H. languens* is proposed as the type of the genus as it is older than *H. imitans* and the Hancock material has shown that it is well defined, although in the past it has often been confused with *H. imitans*, which likewise occurs in the Panamic waters.

KEY TO THE SPECIES OF THE GENUS *Semperothuria*

1. Most tables with flattened base; pillars parallel and ending in eight spines forming a single flat Maltese cross. Supporting rods in feet and papillae mostly narrow, with perforated ends, occasionally with lateral holes. Indo-Pacific. . . . . *imitans* (Ludwig)
1. Most tables with base tapering to a cone, with or without a few spines; pillars rarely parallel, ending in a double Maltese cross on top of spire. Large bars scattered in the skin. . . . 2
2. Numerous spines or rough areas on the broad bars in the skin. Several stone canals. Tentacles dark. Samoa to Batavia. . . . . *flavomaculata* (Semper)
2. Bars in skin smooth or rarely with a few spines. Single stone canal. Tentacles lightly colored. 3
3. Bars usually with dentate edge, rarely closing to form a series of lateral holes. Large form, up to 20 cm long. West Indies, possibly also West Africa. . . *surinamensis* (Ludwig)
3. Bars usually with marginal row of holes, rarely with a few spines present. Small form, to 10 cm long. Panamic region. . . . . *languens* (Selenka)

Semperothuria languens (Selenka)

Pl. 4, figs. 5-7

Holothuria languens Selenka, 1867, p. 335, pl. 19, figs. 80-81. Panning, 1934, II, p. 44, fig. 37 (copied from Selenka).

Non Holothuria languens, Deichmann, 1930, p. 64, pl. 3, fig. 16; 1938, p. 367, text-fig. 3. (In both cases, *H. imitans* Ludwig)

Diagnosis: Length up to about 10 cm. Tables fairly stout, basal part usually conical with a few spines and the top carrying two sets of spines, forming a double Maltese cross; often small spines intercalated between the typical eight pairs, especially in the few tables with the disk still preserved. A scattered deeper layer of flat rods or bars, with marginal holes or dentate edge. Ventral feet with large end plate and large supporting plates with lateral holes; dorsal appendages with small end plate or none and shorter, usually curved, rods, often with dentate ends.

Color usually dull grayish brown with slightly paler area around the appendages and a varying number of dark dots, sometimes fused to two rows of dark spots on the dorsum; ventral side usually paler.

Type: In Germany; paratypes in the Museum of Comparative Zoology.

Type locality: Panama.

Distribution: Apparently restricted to the waters around Panama and a few localities along the coast of Mexico, including Cape San Lucas.

Specimens examined: Selenka's co-types and sixteen specimens secured by the Hancock expeditions in Panama, Bahia Honda, and Taboga Island; Mexico, Tenacatita Bay, Las Tres Marias, Los Frailes, and Cape San Lucas. All ranging from 4 to 10 cm in length and mostly dull grayish brown in color.

Remarks: Selenka's description and figures, though far from perfect, leave no doubt as to which species he had before him. He figured the characteristic spinous conical base of the table and attempted to figure the top with its two circles of spines. Among the large rods, he unfortunately selected one with lateral teeth not united into marginal holes. His types have been re-examined and it was discovered that two of his seven specimens were *Semperothuria languens*, one was a contracted specimen of *Selenkothuria portovallartensis*, and four were *Semperothuria imitans*. This explains why Deichmann in 1930 was misled into thinking that Selenka's species was characterized by tables with a single circle of spines (as in *S. imitans*).

The species is obviously closely related to *Semperothuria surinamensis*, the common species in the West Indies, and Semper's reference to "*H. languens*" in that region refers undoubtedly to that species. The rather restricted distribution of *Semperothuria languens* seems to indicate that it is derived from West Indian stock, while the more common form, *S. imitans*, has come from the West Pacific.

Semperothuria imitans (Ludwig)

Pl. 4, figs. 8-12

Holothuria imitans Ludwig, 1875, p. 109, pl. 7, fig. 41. Théel, 1886, p. 208; 1886a, p. 7. Panning, 1934, II, p. 39, fig. 33, complete list of references. Cherbonnier, 1951, p. 18, pl. 4, figs. 1-15.

Holothuria languens Deichmann, 1930, p. 64, pl. 3, fig. 16; 1938, p. 367, text-fig. 3.

Diagnosis: About 10 cm long, resembling *Semperothuria languens* but appearing more delicate, with a clearer purplish brown coloring, a more distinct pale area around the base of the appendages, and more distinct dark dots or spots. Tables predominately with flat base and parallel pillars in the spire; spire topped by a flat Maltese cross formed by eight spines, rarely a few accessory ones. Complete tables with smooth to spinous disk edge occur, mostly near the appendages, and these often have more irregular clusters of spines on the top—projecting upward or approaching the double Maltese cross in shape. Feet with large end plate, with a few perforated plates around the edge and a number of curved rods or bars, with or without perforated ends and sometimes with lateral projections occasionally forming marginal holes. Similar rods in the dorsal appendages, with the end plate reduced or lacking.

Type: Possibly in Germany.

Type locality: Samoa.

Distribution: In the Pacific Ocean, known with certainty from Samoa (Ludwig), Panama (Théel), and numerous localities along the west coast of the Panamic region, including the Galapagos and other outlying islands.

Depth: Shallow water, usually under flat rocks in pools.

Specimens examined: Several in the Museum of Comparative Zoology, hitherto mistakenly listed as *Semperothuria languens*. A series of 110 specimens, ranging in size from 2 to 10 cm, collected by the Hancock expeditions. The species is common in the Galapagos Islands, where a complete series (2 to 10 cm long) was secured from 16 different stations. It was also taken at Clarion and Cocos Islands, and the Secas Islands, Panama. The remaining records are from the coast of Mexico, from Isabel Island to off Guaymas, at about 27° N, in the Gulf of California.

Remarks: A comparatively large number of small individuals were secured, with a few of the typical spicules but with a preponderance of juvenile tables with large, fragile disk and tapering spire, with several crossbeams and minute blunt teeth. There is of course the possibility

that some of these individuals may represent the young of *Semperothuria languens*, which must have quite similar spicules. However, as far as the present material goes, none of these small individuals were taken where adult specimens of *S. languens* occurred. Both species were preserved in the bottle which contains Selenka's paratypes from Panama, but there is no way of knowing whether this actually represents the one case in which both were found in the same locality, or whether specimens from different localities were lumped together under the general label "Panama."

7. **Irenothuria** n. gen.

Diagnosis: Large species, 20 cm or more, cylindrical to bottle-shaped, with 20 tentacles of moderate size and almost terminal in position. Ventral feet cylindrical, large, arranged in irregular double rows; dorsally the feet more papilliform and arranged in the same manner. Calcareous ring delicate, low; one Polian vesicle and one free stone canal with round head. Cuvierian organs present in some individuals.

Spicules a crowded layer of tables. The largest tables with a disk about 0.2 mm in diameter, with numerous holes and a tall spire with a crossbeam near the base and four long smooth pillars turning outward near the tip, each tapering to a point. Smaller tables also present, especially in the appendages—with shorter spire, often reduced to 1 to 4 knobs or completely lacking. Ventral feet with large end plate; dorsal papillae with no end plate but sometimes a few supporting rods with a few perforations near the ends.

Type species: *Irenothuria maccullochi* n. sp.

Remarks: The genus is monotypic and has been established to accommodate one of the most striking shallow water forms brought home by the *Velero* expeditions. The species was first collected by T. Mortensen in Panama in 1916 but no description was published, as it seemed impossible that so large and unusual a form could be undescribed.

Irenothuria maccullochi sp. nov.

Pl. 4, figs. 1-4

Diagnosis: As for the genus.

Type: Allan Hancock Foundation.

Type locality: Puerto Utria, Colombia, *Velero III* station 232-34.

Distribution: According to our present knowledge, from Puerto Utria, and Octavia Bay, Colombia; Bahia Honda, Panama; Puerto Culebra, Costa Rica; to Ballenas Bay, Gulf of California.

Depth: Intertidal.

Specimens examined: One specimen from Panama, collected by Th. Mortensen (Copenhagen); five collected by the Hancock expeditions, from five stations.

Remarks: The Hancock material ranges in length from 4 to 20 cm. No striking differences were found between the spicules in these different age groups except that they become slightly larger with advancing age.

Although the species is fairly large and occurs at tide level, it must undoubtedly be rare. Superficially it resembles an unusually dark colored *Brandtothuria impatiens*, and it has probably a very similar mode of life. As far as I can judge from the literature, there is no other species which bears the remotest similarity to this form.

It is a great pleasure to name this unusual form, which occupies a position all by itself, for Dr. Irene McCulloch of the University of Southern California.

8. **Vaneyothuria** n. gen.
(**Holothuria lentiginosa** group)

Diagnosis: Large cylindrical forms with up to 20 ventral tentacles and terminal anus; ventral feet varying in number, not crowded and completely retractile; dorsally papillae and smaller feet, the former often on warts, sometimes forming a conspicuous edge along the sides. Inner anatomy not remarkable; one Polian vesicle, one or more stone canals with short cylindrical head, Cuvierian organs present in all forms.

Spicules an outer layer of tables with large disk, with smooth to dentate margin; spire of moderate height, ending in a few sharp teeth, mostly with eight lateral ones forming a more or less irregular Maltese cross and also 4 to 6 vertically placed spines. An inner layer of large buttons, often irregular, slightly twisted, incomplete, or with a few warts; with age, smaller, more regular buttons dominate. Buttons apparently lacking completely in one local form (*Vaneyothuria zacae* forma *azacae*). Ventral feet with end plate and long supporting rods or plates, often as narrow buttons, more or less irregular; dorsal appendages with small end plate or none, and rods or plates, often curved.

Color variable, paler on the ventrum, darker dorsally, gray or brownish, rarely almost white, sometimes with two rows of darker spots dorsally; usually all the appendages, ventrally as well as dorsally, with dark tips and a paler area around the base, not very noticeable on a pale ground color.

The species living normally at remarkably great depth, 50 to 250 fathoms, rarely at 10 to 14 fathoms or less.

Type species: Holothuria lentiginosa v. Marenzeller.

Remarks: In this genus has been included a number of species that Panning, in his revision, scatters in different groups. The oldest is the type species, known from the eastern Atlantic and the West Indies; next come *Holothuria integra* Koehler and Vaney, from the Gulf of Bengal, and *H. neozelanica* Mortensen, from New Zealand, (possibly a synonym of *H. integra*) ; and finally *H. zacae* Deichmann, from the Panamic region. With some doubt, I have also included *H. minax* Théel, from 10 to 14 fathoms, in Japanese waters, a well characterized species and not a synonym of *Stichopus gyrifer* (Selenka) (=*Holothuria monacaria* of Panning and others).

Key to the species of the genus *Vaneyothuria*

1. Tables robust, rarely with marginal spines; spire ending in about 12 sharp teeth, fairly regularly developed. Buttons robust, of great variability, ranging from small, almost regular to large, more contorted. Color golden brown, paler below with pale area around the appendages. Japanese waters, moderate depth, 10 to 14 fathoms. . . . . . . *minax* (Théel)
1. Tables delicate, mostly with some marginal spines. Buttons usually delicate, often twisted, sometimes with a few knobs. Normally from greater depths. 2
2. Color shades of light brown, paler ventrum. Tables mostly with smooth margin. Atlantic form. . . . . *lentiginosa* (v. Marenzeller)
2. Color shades of gray and brown. Tables usually with spinous edge. Indo-Pacific forms. 3
3. Dorsal side grayish brown. 4
3. Dorsal side with two rows of dark brown, almost black, spots, in one form reduced to a small area around some of the dorsal papillae. 5
4. Gulf of Bengal. . . . . . *integra* (Koehler & Vaney)
4. New Zealand waters. . . . . *neozelanica* (Mortensen)
5. Pale form, except for the dark spots on the back and the dark tips of the appendages, with a varying amount of light brown on the dorsum, giving a light tortoise-shell effect. Inner layer of buttons lacking. Galapagos Islands. . . . . *zacae* (Deichmann) forma *azacae* n.f.

5. More or less dark grayish-brown forms. 6
6. Dorsal spots large, general impression a dark tortoise-shell pattern. Gulf of California. . *zacae* (Deichmann) forma *typica*
6. Dorsal spots reduced to a narrow area around some of the dorsal papillae. Color gray-brown, with a faded area around the appendages, giving a general dull, mottled effect. Waters around Cedros and Guadalupe Islands, west coast of Lower California. . . . *zacae* (Deichmann) forma *iota* n.f.

Vaneyothuria zacae (Deichmann) formae typica, azacae, n. f., and iota, n. f.

Pl. 5, figs. 1-12

Holothuria zacae Deichmann, 1937, p. 168, text-fig. 1, nos. 21-28.

Diagnosis: As for the genus, but with two rows of dark spots on the back, in forma *iota* reduced to a dark area around some of the dorsal papillae. Tables fragile, mostly with marginal teeth; in the typical form, sometimes with larger tables near the appendages, with a partly reduced spire ending in four blunt rods. Inner layer narrow buttons, often twisted, incomplete, with a tendency to become smaller and more regular with advancing age—lacking in forma *azacae*, which in addition is unusually pale except for the dark spots and the dark tipped appendages.

Types: The typical form is in the Museum of Comparative Zoology; forma *azacae* and forma *iota* are in the Allan Hancock Foundation.

Type localities: The typical form was taken in Santa Inés Bay, Gulf of California; forma *azacae* came from the Galapagos Islands and forma *iota* from off Cedros Island, west coast of Lower California.

Distribution: The typical form is common in the Gulf of California; one record from Ecuador(?); and none between these two localities; forma *azacae* appears to be restricted to the Galapagos Islands; while forma *iota* is known from off Cedros and Guadelupe Islands.

Depth: Most records are from about 50 fathoms down to 120 fathoms; the few specimens of the typical form, from 10 fathoms and "shore," look definitely beach worn.

Specimens examined: The type and 20 specimens of the typical form; 15 of forma *azacae* and four of forma *iota*.

Remarks: All the material consists of large individuals, mostly about 20 cm in length, with a few measuring only 15 cm. As the material of forma *iota* is much stouter and strongly contracted, it probably

measured 30 to 35 cm when fully expanded. From the large number of specimens taken in the Gulf of California, the species must be fairly common there; and it is remarkable that not one single small individual has been captured. Possibly the younger individuals live at greater depth or are better concealed.

Except for the presence of the rows of dark spots on the back, the species appears to be closely related to *Vaneyothuria integra* and *V. neozelanica.* This is particularly true of *V. z.* forma *iota*, in which the black spots are reduced to small areas around some of the dorsal papillae—a character which may possibly have been overlooked in these two older species. In the larger individuals of the typical form, as well as in *V. z.* forma *iota* (of which only colossal individuals are known), there is an increase in the number of small regular buttons, making the inner layer of buttons similar to that of *V. minax* (Théel) from the Japanese waters. The latter seems to be a less specialized form from shallower water, and still retains the stouter tables of a shore form.

The name *azacae* seems most appropriate for the Galapagos form in which the inner layer of buttons is completely lacking. The name *iota* was selected for the West coast form because some one working with the material had recognized that it differed from that secured in the Gulf of California, and had marked it with the letter "J."

9. **Ludwigothuria** n. gen. (**Holothuria atra** group)

Diagnosis: Large robust forms with large tentacles subventrally directed; numerous feet on the ventrum, sometimes completely retracted, and a large number of smaller feet and papilliform appendages on the dorsum, in some forms tending to become distinct warts. Inner anatomy not remarkable. Some species with numerous stone canals.

Spicules an external layer of tables, not crowded, with small disk, well developed spire, and one crossbeam; spire with 12 teeth, 4 erect and 8 horizontal, forming a Maltese cross. Inner layer consisting of a varying number of minute rosettes or plates derived from these, or slightly larger plates derived from small bifurcate rods. Ventral feet with large end plate and a differing number of narrow to broad supporting rods or plates, with few to many perforations. Dorsal appendages with vestigial end plate or none, and curved to straight rods.

Color ranging from coal black to mottled gray, or with a dark upper side, or reddish to dull gray. Shallow water forms, mostly lying freely exposed in the lagoons.

Type species: Holothuria atra Jaeger.

Remarks: Panning's group is accepted with minor changes. It consists of three West Indian species and two Indo-Pacific forms; the latter are the widespread type species, which reaches the Panamic region, and *Ludwigothuria kefersteini* (Selenka), which appears to be endemic there.

As there seems to be some misunderstanding about *Ludwigothuria atra* and its occurrence in the West Indian waters, a key is given to all five species.

KEY TO THE SPECIES OF THE GENUS *Ludwigothuria*

1. Spicules mostly as simple rosettes. Numerous stone canals. . 2
1. Spicules mostly as small plates with large to small holes. . . 3
2. Smooth-skinned, color uniformly dark brown or black. Rosettes scattered, chiefly derived from forked rods, often forming oval plates with four holes. Indo-Pacific. . . *atra* (Jaeger)
2. Rarely completely brown or black, mostly grayish-yellow, mottled with large dark blotches. Area around base of appendages, if black, usually with white specks, due to the accumulated rosettes. The latter chiefly derived from 3-armed bodies. West Indian waters. . . . . *floridana* (Pourtales)
3. Stone canal single. Plates with relatively large holes and often with short blunt teeth along the edge. Speckled white, black, and gray*; dorsal side often strongly warted. West Indian waters, Brazil, West Africa. . . . *grisea* (Selenka)
3. Numerous stone canals. 4
4. Smooth, thick-skinned form, rarely with indication of warts. Spicules mostly minute plates with small holes, derived from 3-armed rosettes. Usually dark brown dorsal side and pale underside. West Indies. . . . . . . *mexicana* (Ludwig)
4. Not particularly smooth or thick-skinned form, usually with well pronounced warts on the dorsum. Spicules in inner layer a few plates with large holes and usually with blunt teeth along the margin. Color reddish to almost black or fading to a dull grayish, with tips of appendages dark. Panamic region. . . . . *kefersteini* (Selenka)

*Fisher indicates that it is a harlequin of bits of color in life but fades to a "salt and pepper" effect in alcohol. (Deichmann, 1926)

Ludwigothuria atra (Jaeger)

Pl. 2, figs. 18-23

Holothuria atra Jaeger, 1833, p. 22. Panning, 1934, II, p. 30, fig. 22, complete list of references.

Diagnosis: Large form, 20 cm or more, with cylindrical smooth body and large tentacles slightly ventrally directed. Numerous soft, retractile feet on the ventrum; dorsal side with more scattered papillae and small feet. Inner anatomy not remarkable, except for the presence of a large number of stone canals, and often with several Polian vesicles. Cuvierian organs apparently absent.

Spicules tables with a small disk having four marginal holes and well developed spire with the pillars parallel in the upper half and ending in 12 sharp teeth. Inner layer consisting of scattered rosettes, often bifurcate and sometimes forming oval buttons. Feet with large end plate and few, perforated plates, sometimes H-shaped; dorsal appendages with minute end plate or none, and apparently lacking all supporting rods or plates. Color uniformly black or dark brown.

Type: Presumably lost.

Type locality: Celebes.

Distribution: From Mozambique to Hawaii; also reported from the Galapagos Islands and Cocos Island in the Panamic region, and Clipperton Island (H. L. Clark, 1902).

Depth: Shallow water, in lagoons.

Specimens examined: Several in various collections. In the Hancock material are 14 specimens, of which 13 came from the Galapagos and one from Cocos Island; all moderately large, 9.5 to 15 cm long.

Ludwigothuria kefersteini (Selenka)

Pl. 2, figs. 24-26

Stichopus kefersteinii Selenka, 1867, p. 318, pl. 18, figs. 37-40. H. L. Clark, 1922, p. 46 (referred to *Holothuria*). Boone, 1933, p. 156, text-fig. 8.

Holothuria inornata Semper, 1868, p. 252, pl. 40, fig. 1. Deichmann, 1938, p. 365, text-fig. 2. Panning, 1934, II, p. 33, fig. 28.

Diagnosis: Large species, 20 cm or more, with 20 large, almost terminal tentacles. Ventral feet cylindrical, not crowded; dorsally usually four to six rows of low warts, each carrying a small papilla and with smaller, more or less cylindrical feet scattered between them. Inner anatomy not remarkable except for the presence of numerous small stone canals and three or four Polian vesicles.

Spicules an external layer of tables with small or completely reduced disk, often with a few marginal spines; spire well developed, with one cross-beam and four erect and eight laterally projecting teeth; the tables often partly reduced, with either disk or teeth resorbed. An inner layer of scattered small perforated plates, mostly with two to four large central holes and some smaller terminal ones, and a margin with blunt teeth—a deposit definitely derived from the forked rod. Ventral feet with large end plate and narrow to broad supporting plates, more or less symmetrically developed, with numerous holes in the expanded ends; dorsal papillae and feet with vestigial end plate or none, and curved to straight rods with perforated ends.

Color of preserved individuals ranging from almost black with a reddish tinge to a dull putty gray with reddish warts, dark-tipped appendages, and black tentacles.

Type: *Ludwigothuria kefersteini* is in the Museum of Comparative Zoology; *Holothuria inornata* is in Hamburg.

Type locality: Selenka's species came from Acapulco and Semper's from Mazatlán, both on the west coast of Mexico.

Distribution: Common in the Galapagos Islands and also reported from Cocos, Clarion and Socorro Islands. On the mainland from Peru, Ecuador, Panama, and Costa Rica, to the coast of Mexico.

Depth: Shallow water, in lagoons.

Specimens examined: Selenka's type and, thanks to Dr. Panning in Hamburg, Semper's type; several individuals in various collections. From the Hancock expeditions, 75 specimens collected at 40 stations. Of these stations, 21 were in the Galapagos Islands, 2 at Socorro Island, 3 at Clarion Island, and the remainder ranged from Peru to the coast of Mexico.

Remarks: That *Holothuria inornata* was a synonym of *Ludwigothuria kefersteini* was unfortunately not realized until some time after the *Zaca* report was published. H. L. Clark recognized that *kefersteini* was a true *Holothuria* and not a *Stichopus*, but Panning was unaware of this fact, hence the species was not included in his revision of the genus *Holothuria.* He did recognize that *H. inornata* was related to *Ludwigothuria atra*, and placed it in the same division.

The types of *Ludwigothuria kefersteini* are small immature specimens, while Semper's type measures about 20 cm in length. The Hancock material ranges in size from 2 to 20 cm and shows considerable variation both in the external appearance and color and in the development of the spicules.

Panning's record of *Ludwigothuria atra* from the Galapagos refers undoubtedly to Clark's record from Clipperton Island, which Clark had mentioned in his Galapagos report. However, as *L. atra* is rather common in the Galapagos Islands, his statement stands. The first record of *L. atra* in the Panamic region is Clark's 1902 listing of 9 specimens from Clipperton Island.

10. **Selenkothuria** n. gen.
(**Holothuria lubrica** group)

For literature, see Panning, 1934, II, pp. 45-48, text-figs. 38-42.

Diagnosis: Soft-skinned forms with numerous cylindrical feet, forming a more or less distinct ventral sole, sometimes arranged in three broad bands; dorsally numerous minute papillae, not conspicuous, rarely forming low warts. Tentacles more or less terminal in position, often bushy, adapted for plankton catching (?). Inner anatomy not remarkable; certain species with numerous stone canals, others with a single large one; usually one Polian vesicle; gonads as divided threads in a tuft behind the low calcareous ring; Cuvierian organs present in all forms.

An external layer of tables usually completely lacking, though vestiges of tables sometimes found in young individuals of certain species. The inner layer consisting of small rods or plates, smooth or spinous. Ventral feet with large end plate and walls supported by rods or plates of same size as those in the skin, rarely special supporting rods present. Dorsal appendages with reduced end plate or none, and often more curved, shorter rods.

Color dull gray with or without two rows of dark spots and darker anterior end, or dark brown to black.

Type species: Holothuria lubrica Selenka.

Remarks: Although Panning's group is correctly interpreted, he has unfortunately been so loaded down with most of the errors made by earlier writers that many of his conclusions about distribution are completely misleading. Thus his figures of *Holothuria lubrica* var. *glaberrima* represent *H. erinaceus* Semper (=*H. marenzelleri* Ludwig), entirely different from Selenka's *H. glaberrima*, from the West Indies; while the Indo-West Pacific material of *H. lubrica* var. *lubrica* definitely must be referred to *H. moebi*, Ludwig, and so forth.

In order to clarify the situation a key is given to all the accepted species with their approximate geographic distribution.

Key to the members of the genus *Selenkothuria*

1. Spicules as rods, usually with finely spinulated surface; mostly simple with a small hole in each end, rarely with a series of lateral projections sometimes forming a series of holes. Stone canals numerous. From Mauritius to southern Japan. Type locality: Hong Kong, China. . . . *moebi* (Ludwig)
1. Spicules as rods or plates, smooth to dentate; if finely dentate surface, then numerous holes along the edges. Stone canal single, or rarely two. 2
2. Spicules as rods. 3
2. Spicules as plates. 5
3. Rods short, straight, with few stout spines; rarely a few branching or curved. Cape of Good Hope to Gulf of Persia. Type locality: Natal, South Africa. . . . *parva* Lampert
3. Rods mostly curved. 4
4. Spicules delicate curved rods with indistinct spines and mostly a small hole in each end. Brown to almost black. West Indian waters. Type locality: Haiti, W. I. . . . . *glaberrima* (Selenka)
4. Spicules curved rods, rarely with perforated ends (in the tube feet), and strongly to moderately spinous surface. Color varying from grayish, with or without two rows of black spots on the back, to black, with sulphur-colored disks on ventral feet. Panamic region, including the Galapagos Islands. Type locality: Acapulco, Mexico. . . . . . . *lubrica* (Selenka)
5. Spicules plates and broad bars, often curved, with numerous marginal or terminal holes; surface of the margin often spinous. Galapagos to west coast of Mexico. Type locality: Puerto Vallarte, Mexico. . . . . . *portovallartensis* (Caso)
5. Spicules smooth, perforated plates or broad rods with a few holes along the margin of the deposits. 6
6. Spicules predominately plates or short rods with usually few holes and more or less dentate margin. Galapagos Islands and a few localities along the tropical shores of America. Type locality: Galapagos Islands. . . . . . . *theeli* Deichmann
6. Spicules predominately short flat rods, often with forked ends and few lateral or terminal holes. Nicobars, East Indies, including the Philippines. Type locality: Bohol, Philippines (and Nicobars) . . . . *erinaceus* (Semper) (=*Holothuria marenzelleri* Ludwig)

Selenkothuria lubrica (Selenka)

Pl. 6, figs. 1-17

Holothuria lubrica Selenka, 1867, p. 329, pl. 18, figs. 59-60. H. L. Clark, 1923, p. 162. Deichmann, 1937, p. 165; 1938, p. 368, text-fig. 4, nos. 1-5. Cherbonnier, 1951, p. 22, pl. 5, figs. 1-11, 13. Caso, 1954, p. 418, pls. 1-3, 127 figs.

Holothuria lubrica var. *lubrica* (*partim*) Panning, 1934, II, p. 45, list of references (fig. 38, copied from Lampert, refers to *Selenkothuria moebi* (Ludwig), etc.)

Holothuria kapiolaniae Bell, 1887, p. 533, pl. 45, fig. 5. Fisher, 1907, p. 653.

Non Holothuria lubrica, Sluiter, Pearson, *et al.* (See Panning, 1934, II, p. 45; all refer to *Selenkothuria moebi* Ludwig.)

Holothuria pseudo-lubrica Cherbonnier, 1951, p. 22, pl. 4, figs. 16-21; pl. 5, figs. 12, 14-20.

Diagnosis: Medium-sized form usually about 10 cm long, sometimes reaching a length of 15 or 16 cm. Outer and inner features as for the genus; stone canal with a long, spirally furrowed head; occasionally 2 or 3 stone canals present.

Spicules curved rods, about 0.06 mm long, with few to many spines, varying from weakly to strongly developed. Feet with large end plate and a few curved rods in the walls; sometimes these rods with terminal or marginal holes.

Color varying from slate gray, often with two rows of black spots on the back, to mottled gray or brown, with the anterior end almost black; or completely black individuals with sulphur-yellow disks on the ventral feet.

Type: Possibly in Germany; 19 paratypes in the Museum of Comparative Zoology.

Type locality: Acapulco, Mexico.

Distribution: The enormous collections from the Hancock expeditions have shown that the species ranges from Ecuador, Colombia, Panama, and Costa Rica, to the northern end of the Gulf of California. A few specimens have been taken in the Galapagos Islands and Clarion and Socorro Islands. There is a single record from Magdalena Bay, west coast of Lower California, not far from Santa Maria Bay, where H. L. Clark reported some specimens in 1923.

Holothuria kapiolaniae Bell, from Hawaii, was examined in the British Museum. The specimen was dried up but there seems to be no doubt but that it is identical with *Selenkothuria lubrica*, as Cherbonnier

also thinks (1951, p. 21). As the species has never been re-discovered in Hawaii, a fairly well explored region, one feels inclined to believe that the specimen came from the Panamic region and was given a wrong locality label through some error.

Depth: The species appears to live exclusively in the tide zone, where it is usually taken attached to the underside of large, flat rocks.

Specimens examined: The 19 paratypes of *Selenkothuria lubrica*, the type of *Holothuria kapiolaniae*, about 70 specimens in the Museum of Comparative Zoology, and about 500 specimens secured by the Hancock expeditions.

Remarks: The Panamic species is closely related to the West Indian *Selenkothuria glaberrima* and the material collected by Steinbeck and Ricketts and the *Velero III* in the Gulf of California shows that it may reach the same large size and acquire the same dark color, though the West Indian species never has the striking sulphur-colored disks on the ventral feet. The distinguishing character between the two species is the stouter, more spinous rods in *Selenkothuria lubrica*, which rarely have the ends perforated, except in the rods of the tube feet.

In contrast to the majority of the members of the genus, *Selenkothuria lubrica* shows an amazing variability in its outer coloring as well as in its development of the spicules. With a smaller amount of material, I would definitely have split the old species up into two or three smaller groups. However, after having examined more than 500 individuals, from the whole range of the species, I must admit that this is not possible. Generally speaking, the specimens from the Gulf of California have delicate, less spinous rods, and tend to be darker in color, possibly on account of the clearer water which permits the sun's rays to penetrate more deeply; while those from the southern part of the region have more strongly developed spines, and the color is dull gray or brown. The types from Acapulco are dull gray or putty, with two rows of black spots on the dorsum in some individuals. For the most part, they have rods with weakly developed spines, but some, from near by, have rods that are strongly spinous.

I have therefore felt obliged to withdraw *Holothuria pseudo-lubrica* Cherbonnier, from Panama, and have refrained from giving a special name to the magnificent black form with sulphur-colored feet which Mr. Ricketts brought back years ago from the Gulf of California, and which the *Velero III* has also secured.

The records of *Holothuria lubrica* from the Indo-West Pacific refer to other species, such as *Selenkothuria parva*, *S. moebi*, etc., as stated

before (Deichmann, 1938, p. 368; Cherbonnier, 1951, p. 21). The *Holothuria glaberrima's* from the same region are identical with *Selenkothuria erinaceus* (Semper), as Panning's fig. 42 distinctly shows.

Selenkothuria theeli (Deichmann)

Pl. 7, figs. 1-9

Holothuria marenzelleri var.? Théel, 1886a, p. 8.

Holothuria marenzelleri Ludwig, 1887, p. 2, pl. 2, fig. 12 A-E.

Non Holothuria marenzelleri Ludwig, 1883, p. 167 (*H. erinaceus* Semper).

Holothuria marenzelleri Ludwig, var. *théeli* Deichmann (*partim*), 1938, p. 369, fig. 5.

Diagnosis: Large robust form with up to 20 bushy tentacles, often of unequal size, numerous cylindrical feet on the ventrum and slightly fewer small papillae and tube feet on the dorsum. Single free stone canal with elongate head, and one or more Polian vesicles.

Spicules short, forked rods often forming four-holed plates; larger irregular plates with a greater number of holes; margin of plates often with blunt teeth. Feet with large end plate and short curved rods with few holes in the ends; often one end better developed than the other; dorsal feet with or without a remnant of an end plate and also with short rods or plates.

Color dull reddish-brown.

Type: Museum of Comparative Zoology.

Type locality: Charles Island, Galapagos Islands.

Distribution: Common in the Galapagos Islands where Théel's material came from, as well as that from the *Arcturus* expeditions. The *Velero III* reports it from 34 stations with a total of 157 specimens. In addition, the Hancock expeditions brought it back from Zorritos, Peru, La Libertad, Ecuador, Cocos Island, and Ensenada, San Francisco, in Sonora, in the upper part of the Gulf of California (27° N). There are no records from Socorro and Clarion Islands, nor from the west coast of Lower California.

Depth: Shore. From Sta 778-38, the species is reported from 30 to 50 fathoms (?).

Remarks: Théel realized with his usual astuteness that the Galapagos material differed from Ludwig's type material of *Holothuria marenzelleri* from Nankauri, and his description of the spicules agrees completely with the figures Ludwig later drew of his material from the Galapagos Islands. Deichmann, in 1938, established *H. m.* var. *theeli*

on the material examined by Théel and some received from the *Arcturus*, but she also included and figured some material of a new species which later, in 1954, was described by Caso (see below). The variety is herewith given full specific rank, and the accompanying figures of *Selenkothuria erinaceus* (Pl. 7, figs. 10-15) will justify the suppression of *Holothuria marenzelleri*.

The species has its closest affinities with *Selenkothuria erinaceus* (Semper), which is known with certainty from as far eastward as Fiji (Théel's material in Stockholm and material examined by me in the British Museum). But judging by the available material, the latter species does not reach the colossal size of *S. theeli*.

The Hancock material of *Selenkothuria theeli* ranges from 1 to 12 cm in length, but the larger individuals are often so strongly contracted that one could expect them to reach a length of 20 cm when fully expanded.

The time of the year during which the Hancock material was collected, the winter and early spring, may explain why the gonads all appear small. From Bindloe Island, in the Galapagos, a series of 9 well expanded specimens were collected, ranging in length from 1 to 8 cm. The smallest (1 cm in length) individual, which I would estimate to be about six to nine months old, lacks gonads completely, as does also the next stage, which is 2 or 3 cm long and probably a year older. In the individuals 6 or 7 cm long, the gonads measure 0.5 cm in length, while in the largest individual, 8 cm long, they measure 1 cm. Possibly this stage, which probably is about five years old, or the following stage, will develop ripe gonads during the summer months, but this is of course merely speculation.

Selenkothuria portovallartensis (Caso)

Pl. 6, figs. 18-21

Holothuria portovallartensis Caso, 1954, p. 423, pls. 4-10, 224 figs.
Holothuria marenzelleri Ludwig, var. *theeli* Deichmann (*partim*), 1938, p. 370, fig. 6.

Diagnosis: Resembling *Selenkothuria theeli* Deichmann, with 12-20 tentacles, bushy and in younger individuals often of different size. Stone canal usually single, with elongate head, usually one Polian vesicle and small Cuvierian organs.

Spicules flattened rods or bars, often slightly curved, with few to many holes in the ends and with increasing age developing a lacelike festoon of holes along the edges. A low ridge often present along the

middle of the bar, and the edges sometimes finely spinulated; occasionally a third arm developed on the bars. Feet with end plate and a varying number of rods or plates, usually more delicate than those in the skin. Dorsal appendages with small end plate or none, and a few rods or plates. The spicules varying in length, from 0.06 to 0.22 mm, and becoming larger and more complex with age.

Color varying shades of brown and gray, occasionally almost black.

Type: Biol. Inst. U.N.A.M., Mexico.

Type locality: Puerto Vallarte, Jalisco, Mexico (20° 30′ N, 105° 15′ W)

Distribution: The *Velero III* material has shown that this species is extremely common in the Galapagos Islands, where the material came from that Deichmann figured in 1938 as "possibly" being the aged stage of *Holothuria marenzelleri* var. *theeli*. Along the mainland it ranges from Zorritos, Peru, Manta Bay, Ecuador, Octavia Bay, Colombia, Salinas Bay, Costa Rica, Panama, to Tangola Tangola, Cape San Lucas and Puerto Vallarte. Except at the last locality, only a few specimens were collected in one place.

Depth: All the material appears to have been collected at low tide level.

Specimens examined: A few large individuals from the Galapagos (*Arcturus*) and 49 specimens from 17 *Velero* stations. In addition, one individual from Panama was found in Selenka's type material of *Holothuria languens*.

Remarks: The *Velero* material proved definitely that this species could not be the aged stage of *Selenkothuria theeli*, as suggested in 1938. The material ranges in size from 2 to 15 cm and the largest specimens must measure at least 20 cm when expanded.

In a recent paper (1954) Dr. Caso has devoted several pages and numerous illustrations to this species, of which she had 50 specimens from the type locality, ranging in size from 6.8 to 11.3 cm. Her measurements agree with those of the *Velero* material except that she has not found quite as large spicules in her comparatively small specimens. Very likely her locality and Cape San Lucas represent the northernmost limit for the species, and it may not reach the size there that it does in the Galapagos Islands.

Judging from the literature, the species stands rather isolated, without any parallel form in the Indo-West Pacific. Small faded specimens may be mistaken for *Selenkothuria lubrica*, which usually occurs in the same localities, though rare in the Galapagos waters.

In the dark-colored material from Peru, the smallest specimens, 7 or 8 cm long, appear to lack all spicules except the end plates, but otherwise they agree closely with the larger individuals taken in the same spot.

11. Fossothuria n. gen. (Holothuria rigida group)

Diagnosis: Medium-sized forms, 6 to 15 cm long, with flattened body with blunt ends and ventral mouth, surrounded by 20 small tentacles, often completely withdrawn behind the sphincter; anus terminal. Skin rigid from spicules. Ventrally small pedicels, completely retractile, dorsally small papillae. Internal anatomy not remarkable.

Spicules an external layer of tables with knobbed edge and low squat spire with numerous blunt teeth gradually becoming connected with projections from the margin of the disk, resulting in a reticulated hemispherical mass. A crowded layer of regular knobbed buttons, dorsally short with three pairs of holes, ventrally longer with 6 to 12 pairs of holes; in older individuals some of the buttons becoming gradually almost smooth. Ventral feet with end plate and flat supporting rods or plates with few holes in the ends and along the sides of the central part. Dorsal papillae without end plate or only a vestige, and similar rods or plates.

Color white to gray or olive brown; outer pigment often partly destroyed.

Type species: *Stichopus rigidus* Selenka.

Remarks: In this group belong the type species, which ranges from the east coast of Africa to the Panamic region, and *Holothuria cubana* Ludwig from the West Indies (including Selenka's West Indian material of *H. rigida* and Deichmann's *H. fossor*).

Fossothuria rigida (Selenka) formae typica, atypica

Pl. 8, figs. ~~1-13~~ 1 – 11

Stichopus rigidus Selenka (*partim*), 1867, p. 317, pl. 18, figs. 30-31.

Holothuria rigida, Deichmann, 1930, p. 56 (*passim*). Steinbeck & Ricketts, 1941, p. 410.

Holothuria fossor, Panning (*partim*), 1935, IV, p. 106, complete list of references.

Non Holothuria fossor Deichmann, 1926, p. 18, pl. 2, fig. 1 a-j (*Fossothuria cubana* Ludwig)

Cystipus pleuripus Haacke, 1880, p. 47.

Holothuria pleuripus, Ludwig, 1883, p. 174.

Mülleria aegyptiana Helfer, 1912, p. 330, figs. 9-16.
Holothuria (Microthele) aegyptiana, Panning, 1928, I, p. 137, fig. 21.

Diagnosis: As for the genus, but tables consistently smaller than in the Atlantic form (largest with diameter of 0.1 mm as compared with 0.2 mm). Color white or gray, sometimes with indistinct dark spots in two rows on the dorsum. Atypical buttons in a few specimens.

Type: Museum of Comparative Zoology.

Type locality: Zanzibar; also described by Selenka from Hawaii.

Distribution: From the east coast of Africa, including Mauritius and the Red Sea, to the Panamic region. In the latter part of the world reported from the Galapagos Islands, 2 stations, and from 25° to 28° N in the Gulf of California, so it is probably present along most of the west coast of the mainland. Taken by Ricketts & Steinbeck at Mogote and Puerto Escondido, and NE of La Paz.

Depth: Found hidden in sand in shallow water.

Specimens examined: Selenka's types; three specimens collected by Steinbeck & Ricketts; the Hancock expeditions material, consisting of nine typical specimens from six stations and four atypical ones, which possibly in the course of time may develop into a separate local form.

Remarks: The differences between the West Indian and the Indo-Pacific species are slight, and one might in the end either re-unite them all under the oldest name or split the material up into a number of smaller species. The Panamic material seems to be intermediate between the typical form and the West Indian. The tables in the Panamic material so far collected are not as large as those of the West Indian form, but the long buttons tend to develop the same slender form. Also there is a tendency to greater obliteration of the knobs in the ventral buttons in the Panamic material.

Panning did not realize that Deichmann's *Holothuria fossor* was a synonym of Ludwig's *Fossothuria cubana*, hence the same species appears twice in his account, and unfortunately *H. fossor* is given as ranging from the West Indies to Amboina and Mauritius. Panning's Indo-Pacific *H. fossor* should be re-named *Fossothuria rigida*, while his West Indian *Holothuria fossor* should be withdrawn as a synonym of *Fossothuria cubana*, as should also H. L. Clark's West Indian *Holothuria hypamma* and *H. rigida.*

12. **Jaegerothuria** n. gen.
(**Holothuria inhabilis** group)

Diagnosis: Burrowing forms with small ventral tentacles and small

ventral feet, with more or less well pronounced dorsal papillae, usually quite distinct along the flanks. Skin packed with spicules consisting of an outer layer of clumsy tables with knobbed to spinous disk and a low spire, with few teeth on the top and an inner layer of irregular knobbed buttons with from 3 to 7 pairs of holes, often forming an irregular mesh. Ventral feet with end plate and broad supporting plates with a varying number of holes; in the papillae often a trace of an end plate and usually curved supporting rods. Color varying shades of light brown.

Type species: *Holothuria inhabilis* Selenka.

Remarks: The large type species is widespread in the Indo-Pacific, including Hawaii and the Panamic region, at a depth of from 10 to about 100 fathoms. In the West Indies a presumably smaller species occurs at a depth of about 200 fathoms, *Jaegerothuria occidentalis* (Ludwig). Possibly there are other incompletely known species in the Indo-Pacific which should be referred to this group, either as independent species or as synonyms of the type species.

Jaegerothuria inhabilis (Selenka)

Pl. 8, figs. ~~14-19~~ 12-19

Holothuria inhabilis Selenka, 1867, p. 333, pl. 19, figs. 73-74. Panning, 1934, III, p. 79, text-fig. 62 (after Selenka). Deichmann, 1937, p. 164. H. L. Clark, 1946, p. 433.

Holothuria hypamma H. L. Clark, (*partim*), 1921, p. 177, pl. 38, figs. 20-24; 1932, p. 232. Panning, 1935, IV, p. 102, fig. 95 (after H. L. Clark). Not his West Indies *hypamma*=*cubana* Ludwig, see above.

Holothuria parinhabilis Cherbonnier, 1951, p. 27, pl. 8, figs. 1-13; pl. 9, figs. 1-7, 10.

Diagnosis: Large form, 20 cm or more, stout, with 20 small ventral tentacles, terminal anus. Dorsal side with numerous small conical papillae, in younger individuals often forming a distinct margin along the sides; ventrally small feet. Skin packed with spicules consisting of an outer layer of tables with knobby to spinous margin of disk and low spire with numerous short spines on the top; in older individuals the tables often reduced and scarce. The inner layer consisting of knobbed, more or less irregular buttons, ranging from large (in young individuals) to short ones. The number of holes varying from 6 or 7 pairs to 3 pairs. Ventral feet with small end plate and numerous supporting plates with a varying number of lateral holes. Dorsal papillae often with a trace of an end plate and smaller, mostly curved supporting rods.

Type: Both *Holothuria inhabilis* and *H. hypamma* are in the Museum of Comparative Zoology.

Type locality: Hawaii (small individuals). The large individuals of *Holothuria hypamma* came from Mer Island, Murray Islands, Torres Strait. Clark also had small individuals from Green Island, Queensland (approximately 16° 80′ S, 146° E), and Port Galera, Philippines.

Distribution: Ranges from Hawaii to the Australian waters in the west and to the Panamic region in the east. The species was reported from various localities in the latter region in 1937, including Clarion Island, and the Hancock expeditions have further extended the range by bringing back 19 specimens from the Galapagos Islands, Ecuador, Cocos Island, and four localities in the Gulf of California, between 27° and 29° N.

Depth: Nothing is known about the depth at which the types of Selenka and Clark were taken, but probably it was rather shallow water. The Hancock material came from 8 to 111 fathoms, with the majority of the specimens taken at 20 to 50 fathoms.

Specimens examined: The types and paratypes of *Holothuria inhabilis* and *H. hypamma*; three specimens from the *Zaca* expeditions; Ludwig's *H. maculata* from Cocos Island, 66 fathoms (U.S.N.M.); and the 19 specimens collected by the *Velero III*.

Remarks: The material on hand ranges in length from 7 to 20 cm, the larger specimens so strongly contracted that they undoubtedly would measure 25 to 30 cm when expanded. The color varies from almost white to pale brown, darker above, sometimes with indistinct large spots or sprinkled with dark dots. The smaller individuals may be reminiscent of *Fossothuria rigida*, but the skin is less rough to the touch and the papillae, particularly the lateral ones, are usually distinct. The buttons are so different in the small and the large individuals that one at first is inclined to refer them to different species. In the young individuals there is a preponderance of elongate buttons with 5 to 7 pairs of holes and the middle bar often projects at one or both ends. In the large individuals a smaller, more regular knobbed button with six holes becomes dominant while the tables are more or less resorbed.

H. L. Clark in 1946 withdrew the name *Holothuria hypamma* as a synonym of Selenka's *H. inhabilis*. Most likely Jaeger's *H. fuscopunctata*, from Celebes, is identical with *Jaegerothuria inhabilis*; Semper's figure of a large complex button is rather suggestive of one of the large buttons in the *J. inhabilis* material. Fortunately, as Clark has pointed

out, Jaeger's name is invalidated by Quoy and Gaimard's older name, which again is a synonym of Lesson's *Holothuria monacaria*—so Selenka's name must stand.

13. Theelothuria n. gen.

Diagnosis: Large spindle-shaped forms, up to 20 cm or more, with 20 small terminal tentacles. Conical appendages fairly uniformly distributed in the adult specimens; ventrally the appendages ending in a cylindrical soft retractile tube foot, dorsally in a papilla. Calcareous ring with remarkably tall radials, slightly excavated posteriorly, forming short "tails"; interradials of the usual type. Color varying in the same species from almost black to pale yellow, with or without large dorsal spots. Appendages surrounded by a narrow white ring, rather inconspicuous in the pale individuals.

Spicules an outer layer of tables with a circle of marginal holes and blunt, upward-bent spines; spire low with few teeth; in older individuals these tables reduced to irregular four-holed plates. An inner layer of irregular buttons with or without a few knobs; in one species the buttons become gradually smooth with small holes which tend to become obliterated. The ventral feet with end plate and straight to curved supporting plates with a row of holes along the sides and often a few knobs. In the papillae the end plate reduced or lacking and the curved rods with fewer holes along the sides. Most individuals have a few huge tacklike tables in the appendages, visible to the naked eye, consisting of a larger or smaller disk with numerous holes and tapering into a tall conical spire sometimes showing traces of being composed of four pillars. In one species the young individuals (3 cm long) lacking the inner layer of buttons but with juvenile tables of the synallactid-type, with cross-shaped disk.

Burrowing forms rarely taken at low tide, mostly from 10 to 50 fathoms. Not common in most collections.

Type species: Holothuria princeps Selenka.

Remarks: The group is rather incompletely known and the five or more species known from the Indo-Pacific which appear to belong in this genus may possibly be reduced to two or three. The type species is well known from the West Indies (including its synonym, *Holothuria imperator* Deichmann) and we are fortunate in that there is only one species in that region. From Panama one species is described which is clearly separated from the type species, but it is quite possible that it

will be found to be identical with one of the older forms and thus represent a migrant from the Indo-Pacific.

No attempt has been made to compose a key, as I feel I have not enough material from the Indo-West Pacific to justify it. The other species which in my opinion should be referred to the genus are: *Theelothuria squamata* (Semper), *T. spinulosa* (Théel), and *T. maculosa* (Pearson), all placed in the same group as *T. princeps* in Panning's revision; Ludwig's *T. notabilis* (and Deichmann's *Holothuria imperator*), referred to another group; and Semper's *Theelothuria aculeata*, which Panning places in a third group—an indication of how difficult it is to interpret the older descriptions without any material. But even where material is available, it is not too easy to draw the line between these forms.

Theelothuria paraprinceps (Deichmann)

Pl. 9, figs. 1-18

Holothuria paraprinceps Deichmann, 1937, p. 166, text-fig. 1, nos. 1-10. Steinbeck & Ricketts, 1945, p. 409, pl. 19, fig. 1.

Diagnosis: As for the genus, with the buttons in older individuals becoming smooth, fairly regular with minute holes or none, particularly in the ventrum. Color varying from almost black with a narrow light ring around the base of the appendages to light brown with two rows of darker spots on the dorsum and also in some cases a darker area along the middle of the ventrum. The general impression of the light-colored individuals is of mixed salt and pepper. Young individuals, few cm long, almost colorless, the slightly larger ones reddish brown, often with the appendages pale except for a ring of dark pigment near the base, setting off the light area around it.

Type: Museum of Comparative Zoology.

Type locality: Arena Bank, Gulf of California, 35 fathoms.

Distribution: As far as known ranging from the lower end of the Gulf of California to Panama (material in Copenhagen) and southward to Cocos Island, also taken at Clarion Island.

Depth: From tidemark down to about 35 fathoms.

Specimens examined: The type, several specimens collected by Steinbeck & Ricketts (all dark) from El Mogote, Lower California, one collected in Panama by Dr. Mortensen, and eight specimens collected by the Hancock expeditions, from Cocos Island, 30-50 fathoms, Clarion Island, shore and 28-35 fathoms, and from Cape San Lucas and Concepcion Bay (26° N).

Remarks: The Hancock material has demonstrated how variable the color is in this species. The larger of the two specimens from San Lucas is sufficiently well expanded to permit a description of the color pattern. The dorsal side is light brown with darker papillae of varying size and with a white area around the base; in addition there are seven dark spots in two rows on the back. Ventrally the animal is almost white with dark brown appendages and a white line stretching down along the midline.

From the same locality and depth the expedition was fortunate enough to secure a well expanded specimen, about 3 cm long, with very interesting spicules. The inner layer of buttons appears to be totally lacking, as is so often the case in the younger stages, but the characteristic tacklike tables are present in numbers, though scaled down to the size of the animals. In addition one finds numerous juvenile tables with a delicate disk, complete and with slightly spinous edge, and a more perfectly developed spire than is usually found in older individuals; and most important, a number of large tables with cross-shaped disk and tall spire, with or without crossbars and teeth; in a few cases a narrow band extends from the edge of the arms so that a complete circle is formed (synallactid-type).

In the 5 cm specimen from Clarion Island, 32 fathoms, the buttons have begun to appear and are large with few knobs. The tables are usually reduced as in the adult, although a few of the primitive synallactellid tables are still present. In the remaining specimens, which range in size from 8 to 14 cm, strongly contracted, the spicules are of the typical form with a preponderance in the ventrum of almost flat buttons with small holes.

The species is probably more common than the few records indicate but it escapes detection due to its burrowing habits. Where the conditions are suitable in shallow water, it is usually taken in large numbers, as Steinbeck & Ricketts records indicate.

That it apparently does not extend far up into the Gulf of California may indicate that it is a comparatively recent migrant from the West Pacific, if the assumption is correct that it also occurs in the Indo-West Pacific, concealed under an older name. It is noteworthy that no representative of the genus has been taken in the Hawaiian Islands, although this may be because the burrowing types have not been studied intensively in that region, which abounds in free-living forms.

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PLATE 1

Figs. 1-3.	*Isostichopus fuscus* (Ludwig). Tables and C-shaped body.
Fig. 4.	*Isostichopus badionotus* (Selenka). Table.
Fig. 5.	*Labidodemas americanum* Deichmann. Table from type specimen.
Figs. 6-9.	*Microthele difficilis* (Semper). Table, disk of table, plate from wall of tube foot, and button.
Figs. 10-13.	*Brandtothuria arenicola* (Semper). Buttons with relatively large holes, table, and supporting rod.
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Fig. 18.	*Brandtothuria gyrifer* (Selenka). Synallactidlike disk of table from 3 cm long specimen.

(Magnification: Each division is 1/100 mm)

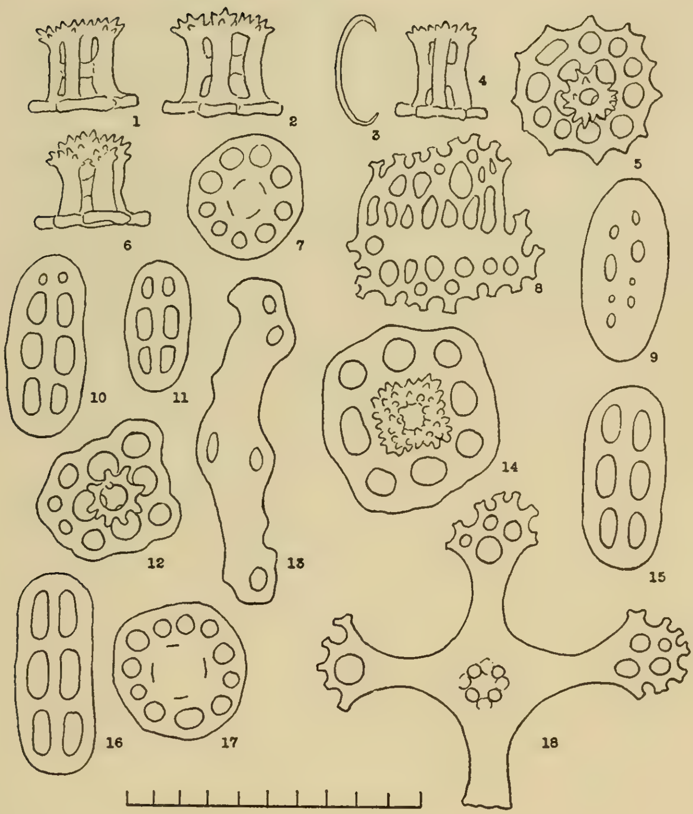
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PLATE 2

Figs. 1-16.	*Lessonothuria pardalis* (Selenka). Tables and table disks, and different types of buttons.
Fig. 17.	*Lessonothuria pardalis* (Selenka). An unusually delicate table from a young individual.
Figs. 18-23.	*Ludwigothuria atra* (Jaeger). Tables and rosettes.
Figs. 24-26.	*Ludwigothuria kefersteini* (Selenka). Table, plate, and supporting rod from tube foot.

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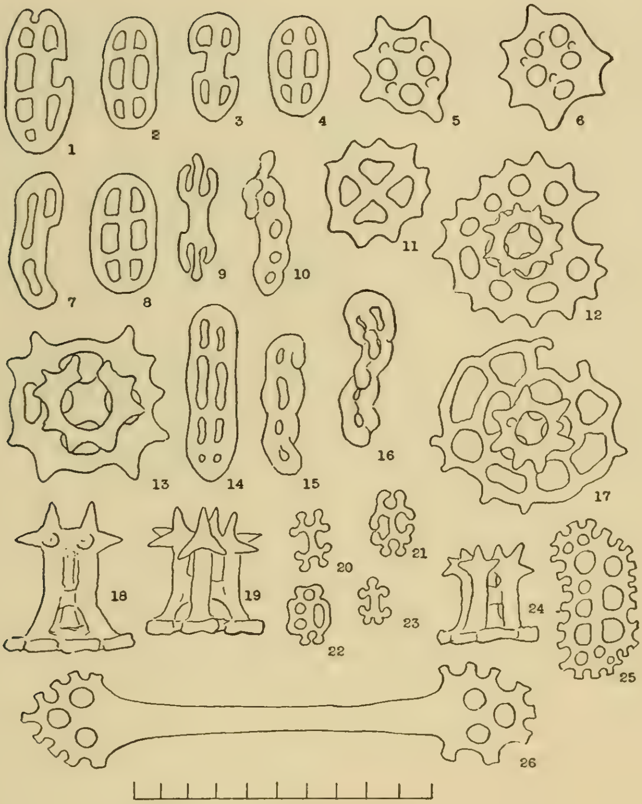
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PLATE 3

Figs. 1-9. *Mertensiothuria leucospilota* (Brandt). Supporting plate from tube foot, buttons, table, and crown of spines on table.

Figs. 10-12. *Mertensiothuria platei* (Ludwig), from Juan Fernandez. Buttons or plates from paratypes.

Figs. 13-23. *Mertensiothuria fuscocinerea* (Jaeger). Buttons from skin.

Figs. 24-29. *Mertensiothuria pervicax* (Selenka), from Hawaii. Buttonlike rosettes and table with reduced spire. Similar tables are also present in the skin of *M. fuscocinerea*, but rare in both forms.

(Magnification: Each division is 1/100 mm)

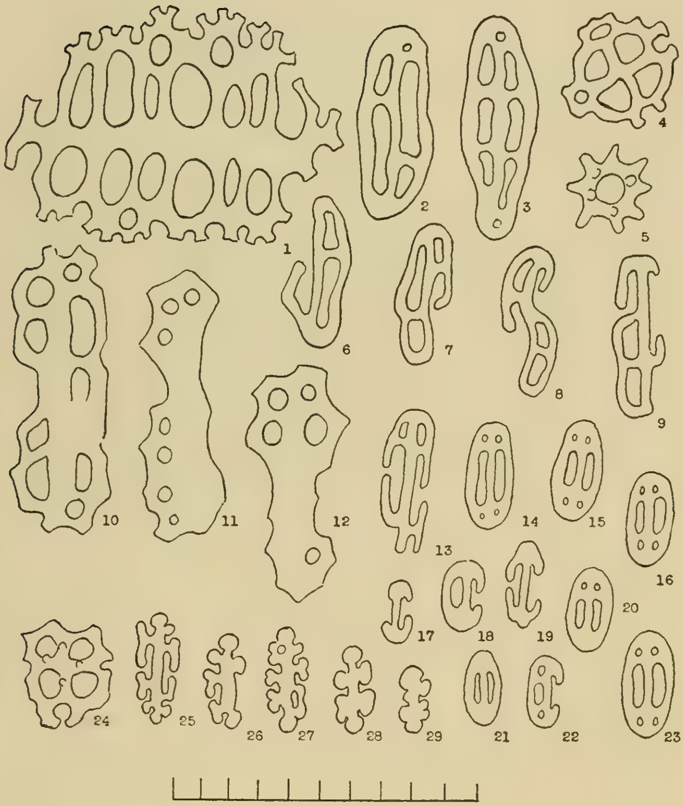
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PLATE 4

Figs. 1-2. *Irenothuria maccullochi* Deichmann. Disk of large table and profile of table.

Figs. 3-4. *Irenothuria maccullochi* Deichmann. Small tables, seen from above.

Figs. 5-7. *Semperothuria languens* (Selenka). Typical tables, side view.

Figs. 8-10. *Semperothuria imitans* (Ludwig). Typical tables, side view.

Figs. 11-12. *Semperothuria imitans* (Ludwig). Top of spire seen from above.

(Magnification: Each division is 1/100 mm)

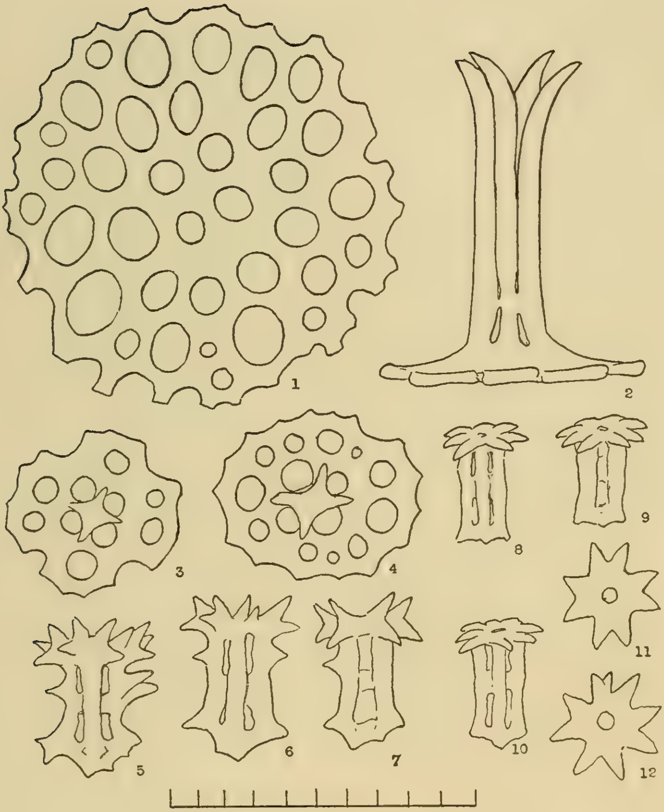
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PLATE 5

Figs. 1-5. *Vaneyothuria zacae* (Deichmann), forma *typica*, from the Gulf of California. Tables and buttons.

Figs. 6-12. *Vaneyothuria zacae* (Deichmann), forma *azacae*, from the Galapagos Islands. Fragile tables and a rare button and supporting rods.

(Magnification: Each division is 1/100 mm)

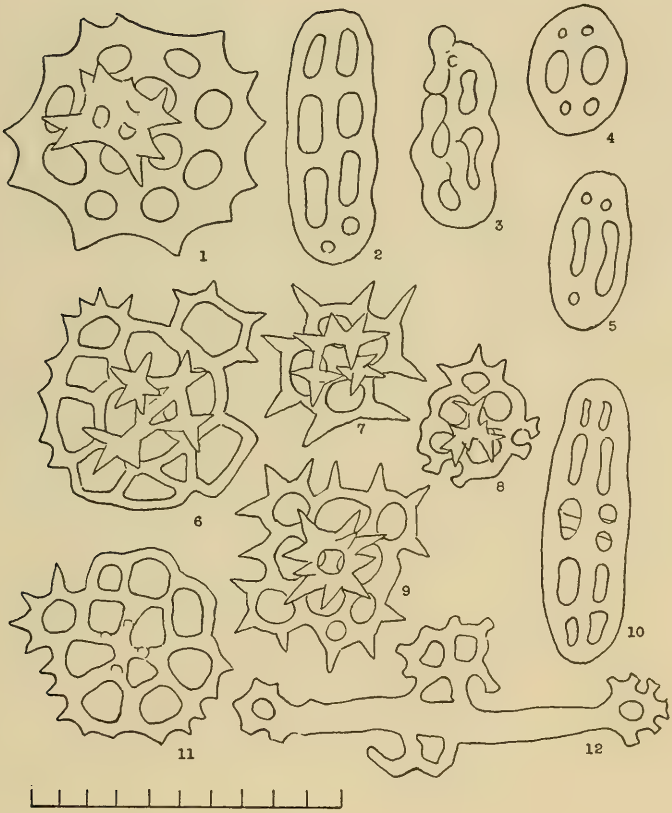
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PLATE 6

Figs. 1-17. *Selenkothuria lubrica* (Selenka). Variation of rods in different individuals. Figs. 8-12, from the type specimens.

Figs. 18-21. *Selenkothuria portovallartensis* (Caso). Plates and rods from specimens from the Galapagos.

(Magnification: Each division is 1/100 mm)

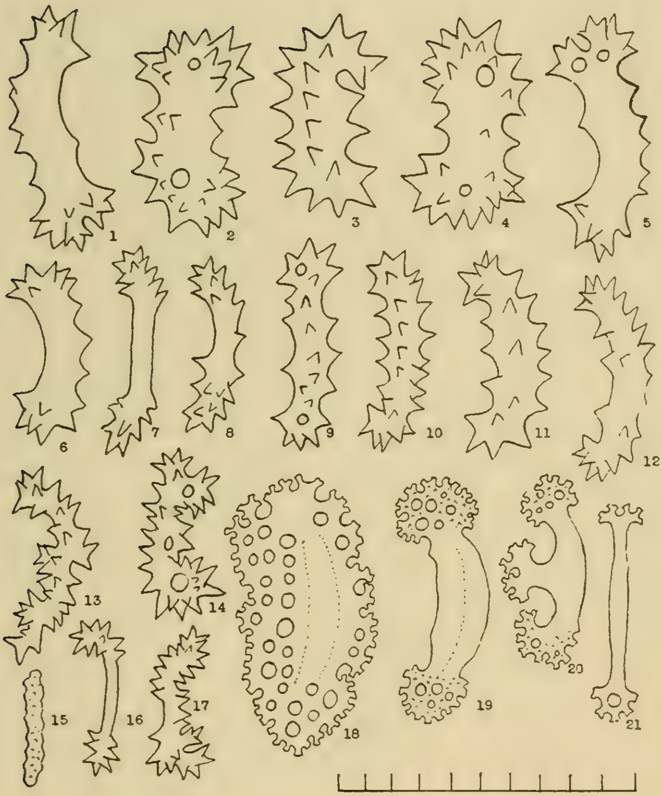
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PLATE 7

Figs. 1-9. *Selenkothuria theeli* (Deichmann). Plates and rods from skin of type, from Galapagos.

Figs. 10-15. *Selenkothuria erinaceus* (Semper)=*Holothuria marenzelleri* Ludwig, from the Indian Ocean. Rods and plates from the skin.

(Magnification: Each division is 1/100 mm)

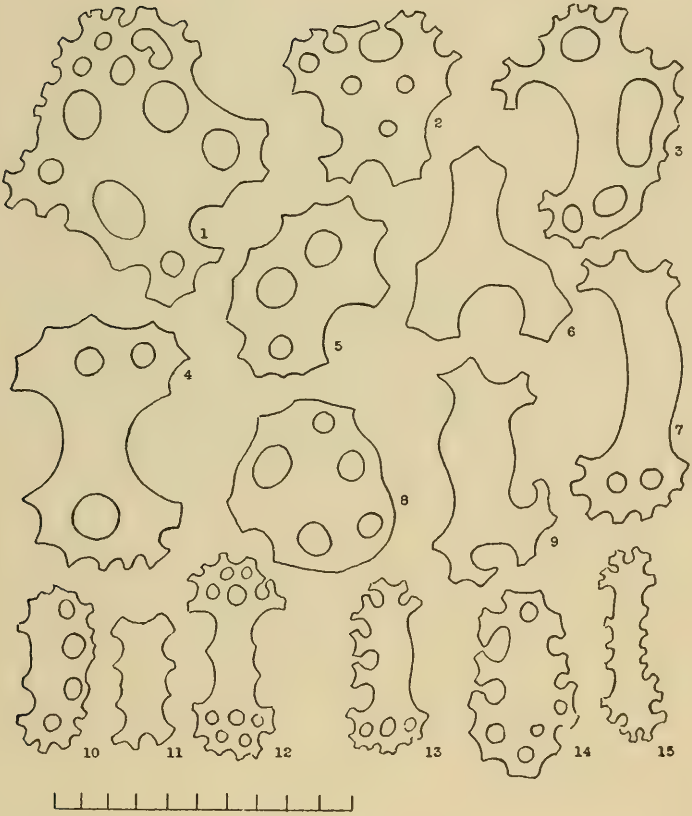
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PLATE 8

Figs. 1-7. *Fossothuria rigida* (Selenka). Large and small buttons and comparatively simple table from a typical individual, Panamic region.

Figs. 8-11. *Fossothuria rigida* (Selenka), forma *atypica.* Abnormal buttons from a specimen from Panama, 5 cm long.

~~Figs. 12-13. *Fossothuria rigida* (Selenka), forma *atypica.* Contorted bodies, very unlike the regular button of the typical form.~~

Figs. 1~~4~~2-19. *Jaegerothuria inhabilis* (Selenka). Buttons and tables from specimens from the Panamic region. Fig. 16 is a table from a young individual.

(Magnification: Each division is 1/100 mm)

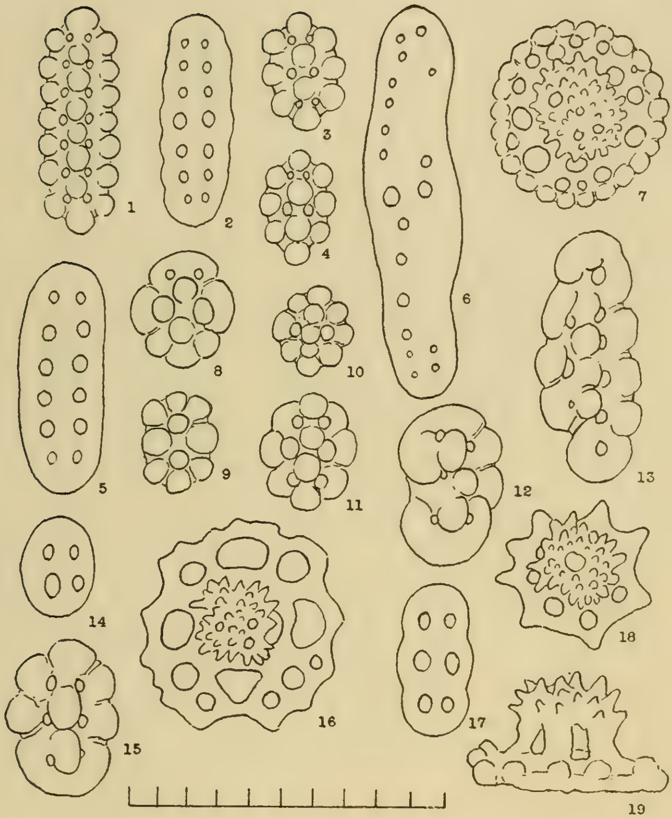
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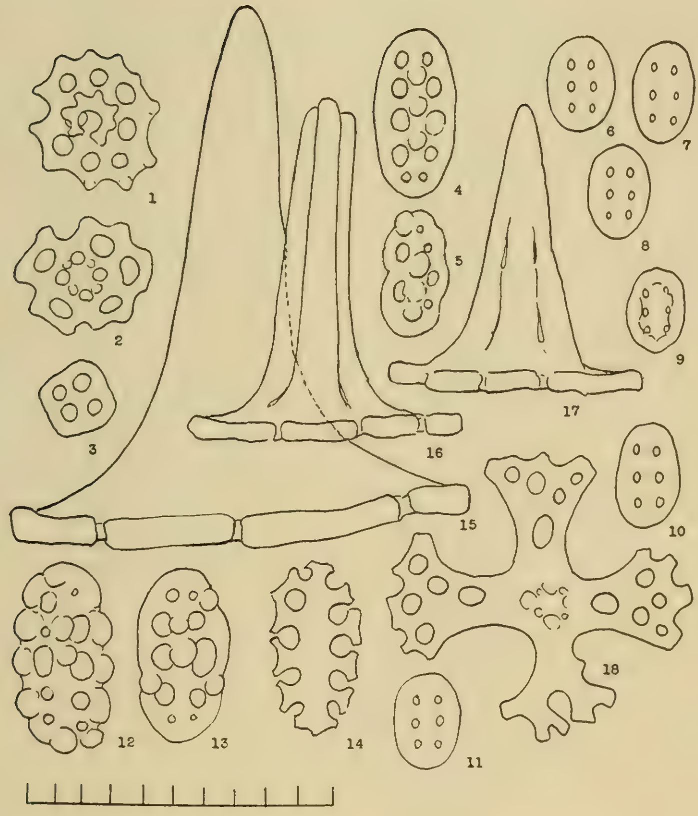
PLATE 9

Theelothuria paraprinceps (Deichmann)

Figs. 1-3.	Reduced tables from skin.
Figs. 4-14.	Various stages of buttons; the small smooth ones are from the ventrum.
Fig. 15.	Large tack-shaped table from adult.
Figs. 16-17.	Smaller tack-shaped tables from specimen a few cm long, with traces of fusion of separate pillars.
Fig. 18.	Synallactidlike type of table from young individual from off San Lucas.

(Magnification: Each division is 1/100 mm)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ALLAN HANCOCK PACIFIC EXPEDITIONS
VOLUME 11 NUMBER 1

SPONGES OF THE GULF OF CALIFORNIA

(PLATES 1-97)

by
MALCOLM GIBSON DICKINSON
ALLAN HANCOCK FOUNDATION

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